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New Hampshire Agricultural Experiment Station

BULLETIN 367 SEPTEMBER, 1946

# Agricultural Research in New Hampshire

*Annual Report of the Director of the Agricultural Experiment Station For the Year Ending June 30, 1946*

AGRICULTURAL EXPERIMENT STATION
UNIVERSITY OF NEW HAMPSHIRE
DURHAM, N. H.

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# NEW HAMPSHIRE AGRICULTURAL EXPERIMENT STATION STAFF

## July 1, 1946

### ADMINISTRATION

M. Gale Eastman, Ph.D., Dean and Director
Harold C. Grinnell, Ph.D., Assistant to Dean and Director
Russell C. Smith, Purchasing Assistant
Ella S. Bowles, Editor
Thelma Brackett, A.B., Librarian
Wilfred T. Harwood, Library Assistant in Charge, Plant and Animal Sciences Library

### AGRICULTURAL AND BIOLOGICAL CHEMISTRY

Thomas G. Phillips, Ph.D., Chemist
Todd O. Smith, M.S., Associate Chemist
Stanley R. Shimer, M.S., Assistant Chemist
Gordon P. Percival, M.S., Assistant Chemist
Helen J. Purinton, Ph.D., Assistant Chemist
*Arthur E. Teeri, Ph.D., Assistant Chemist
Henry A. Davis, M.S., Assistant in Agricultural and Biological Chemistry
Margaret Loughlin, A.B., Assistant in Agricultural and Biological Chemistry

### AGRICULTURAL ECONOMICS

Harry C. Woodworth, M.S., Agricultural Economist
Max F. Abell, Ph.D., Assistant Agricultural Economist
Harold C. Grinnell, Ph.D., Assistant Agricultural Economist
Lawrence A. Dougherty, B.S., Assistant Agricultural Economist
John C. Holmes, A.B., Assistant in Research in Agricultural Economics

### AGRICULTURAL ENGINEERING

George M. Foulkrod, M.S., Associate Agricultural Engineer

### AGRONOMY

Ford S. Prince, B.S., Agronomist
Leroy J. Higgins, B.S., Associate Agronomist
Paul T. Blood, M.S., Assistant Agronomist
Louis T. Kardos, Ph.D., Assistant Agronomist
Bessie G. Sanborn, Seed Analyst

### BACTERIOLOGY

Lawrence S. Slanetz, Ph.D., Bacteriologist
Fred E. Allen, D.V.M., Veterinarian
Ian M. Miller, B.S., Graduate Assistant in Bacteriology
Lillian M. Richards, B.S., Laboratory Technician in Bacteriology

### BOTANY

Albion R. Hodgdon, Ph.D., Plant Taxonomist
Stuart Dunn, Ph.D., Plant Physiologist
Mathias C. Richards, Ph.D., Plant Pathologist

### DAIRY HUSBANDRY

Kenneth S. Morrow, M.S., Dairy Husbandman
Ernest G. Ritzman, M.S., Research Professor Emeritus in Animal Husbandry
Harry S. Keener, Ph.D., Associate Dairy Husbandman
Herbert C. Moore, M.S., Assistant Dairy Husbandman
*Nicholas D. Littlehale, Herdsman

### ENTOMOLOGY

James G. Conklin, Ph.D., Entomologist
Walter C. O'Kane, M.S., D.Sc., Prof. of Entomology
Robert L. Blickle, Ph.D., Assistant Entomologist
Wallace J. Morse, B.S., Research Assistant in Entomology

### FORESTRY

Clark L. Stevens, M.F., Ph.D., Forester
Lewis C. Swain, M.F., Assistant Forester

### HOME ECONOMICS

Barbara Connor, B.S., Graduate Assistant in Home Economics

### HORTICULTURE

Albert F. Yeager, Ph.D., Horticulturist
L. Phelps Latimer, Ph.D., Assistant Horticulturist
Elwood W. Kalin, M.S., Greenhouse Superintendent
Henry S. Clapp, M.S., Assistant Horticulturist
William W. Smith, Ph.D., Assistant Horticulturist
Richard J. Hopp, Graduate Assistant in Horticulture
C. Lyman Calahan, B.S., Horticultural Farm Superintendent
James Macfarlane, Greenhouse Assistant

### POULTRY

T. Burr Charles, M.S., Poultry Husbandman
Richard C. Ringrose, Ph.D., Assistant Poultry Husbandman
Fred E. Allen, D.V.M., Veterinarian
Alan C. Corbett, D.V.M., Assistant Poultry Pathologist
Edwin T. Bardwell, B.S., R.O.P. Inspector
Richard S. Ford, Senior Laboratory Technician in Poultry Husbandry
Donald S. Cross, Senior Laboratory Technician in Poultry Husbandry
Jean French, Laboratory Technician in Poultry Husbandry
Ruth E. Rinta, Assistant Laboratory Technician in Poultry Husbandry

### ASSISTANTS TO THE STAFF

Maisie C. Burpee, Secretary
Theresa R. Batchelder, Mail Clerk
Martha E. Fisher, Senior Stenographer-Clerk
Kathrina H. Legg, Senior Stenographer-Clerk
Amber H. Hall, Senior Stenographer-Clerk
Sara M. Sanborn, Senior Stenographer-Clerk
Laverna E. Murphy, Senior Stenographer-Clerk
Edith M. Smith, Senior Stenographer-Clerk
Rosamond E. Ferry, Senior Stenographer-Clerk
Adrienne Girard, Stenographer-Clerk
Claire Girard, Stenographer-Clerk
Dorothy Noyes, Stenographer-Clerk
Bernadine E. Davis, Stenographer-Clerk
Mildred Fullington, Stenographer-Clerk
Gloria Chagnon, Stenographer-Clerk
Patricia H. Spalding, Stenographer-Clerk
Margaret Miller, Stenographer-Clerk

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*On leave.

# Agricultural Research in New Hampshire

During the fiscal year ending June 30, 1945, the war clouds were finally riven by the capitulation of Japan. This country, as the second of the last two Axis powers to succumb, signed her articles of surrender, September 2, 1945. This second World War, was the costliest and most destructive of all time. Of this there can be no question. The cost of the war was put at $1,154,000,000,000 for the world in armament and military materials with an added $230,900,000,000 for civilian property damage. These estimates based on surveys made and compiled by James H. Brady and the American University do not include the money spent and the damage done incident to hostilities in China, because none of the figures for that country were available.

The dead in World War II, including both military and civilian, was placed at 22,060,000 according to a compilation released by the Vatican in November; the same report placed the wounded at 34,400,000. Several international agencies had contributed to this resume.

These losses in money and in man power are still only an index to resulting total costs. They do not measure the loss of time and materials in the feverish conversion of civilian effort to war production; much less do they measure the difficulties of going back to peace-time pursuits. The probabilities of a long postwar period of adjustment and readjustment before the dislocation of men and materials and the attendant price relationships can be restored to a semblance of equilibrium is scarcely less than obvious.

As New Hampshire farmers anticipate the cessation, or gradual alleviation, of some of the difficulties incident to wartime restrictions and burdens imposed by the rigors of such a war they can harbor no small amount of pride in the contribution they made to the successful culmination of this conflict. Not only did our farmers furnish a quota of food commensurate with our natural resources of soil and climate but they did it in spite of decreasing man-power in order to contribute a full share of farm-raised boys to help to fill the ranks of the far-flung battle lines.

And some of the morale for agricultural production rested on more personal and intimate considerations than the general recognition that an army travels on its stomach. A farmer might think of his own boy as one who could easily come to be stationed at some outpost in a far-away inhospitable climate among people whose foreign words were unintelligible. The ennui of such an existence for a small group might be more unendurable even than the dangers of the fiercest fighting on the most active front. Any shortage of food for such a handful of men in its lonely life could supersede in importance everything else. The failure of one meal might initiate mental misgivings too serious to contemplate. With such thoughts in mind, long hours or tired muscles on New Hampshire farms were not sufficient handicaps to decrease production. Production was increased.

Not only did older people, women, and children rally to labor for more crop and animal production but machinery whenever available was

purchased at a sacrifice if necessary or pressed into greater service to offset human labor.

Much of our organized experimental work in agriculture during the war has reemphasized the importance of helping the farmer to attain more production and much more efficiency. Studies of transportation systems for milk in the rural areas to save distances travelled and reduce the consumption of gasoline and rubber; studies of "fast milking" and other "chore practices" to make better use of equipment in the barn and greatly reduce the hours of man labor required; the selection and methods of application for new insecticides, of which DDT is a well-known example, to favor better growth and better quality of plants and better production of animals; studies of trace elements in soils leading to spectacular improvements in the health of livestock; better combinations of fertilizer elements and methods of application that shall contribute to larger crops; similar studies with newly discovered and greatly improved fungicides for the control of plant diseases; significant progress in the breeding of better crops of vegetation for humans and better forage for animals have been effected. These are but examples of cooperative effort and progress with a diversity of work well distributed among a conscientious research staff. Much service work of special importance to the State in a war economy has been accomplished in the inspection of feed, fertilizers, and seeds; and thousands of tests and diagnoses of diseases among poultry and large animals have been made.

In other words, not all changes incident to war are confined to the strategy of deploying troops; not all inventions are confined to weapons. Radar and possibly atomic bombs may have their civil applications. The old maxim that there can be no great loss without some small gain should emphasize to farmers the likelihood of possible positive changes even in the ancient business of cultivating crops and harboring animals. Some of the new things developed by regular agricultural research, such as new farm management techniques resulting from labor emergencies and new field machines as coutnerparts of those used for the solution of war problems, will doubtless contribute to significant change.

Farmers in New Hampshire must, therefore, realize that change is imminent. This change will involve keeping up-to-date in selecting better seed and better varieties of crops; in using better adapted fertilizers with possible better methods of application; in using machinery not alone to plow and harrow but to elevate crops from the ground to the wagon or to the barn, perhaps; to clear manure from the stable and shovel it on the spreader; to remove stone walls, brush, surplus water and other impediments to pasture improvement and larger and more economical field arrangements. This all means more production per man-hour of labor, than which there is no better measure of efficiency in American farming. With hand milking, ten cows twice a day was a man's job, but with improved milking machines and a better understanding of the physiology of the cow, a man's stint may become forty cows instead of ten. These enumerations are but examples of new things that must happen in farming, even in New Hampshire, in order to keep up with progress. Farming is a dynamic, changing business. Every new farm machine that is invented

makes farming harder for the man who does not use it. War periods are followed by postwar conditions and together they initiate eras of great change, from which agriculture is not immune. Farming is now, without question, a scientific business. It requires not only brawn but brains, and it provides infinite opportunity fo rthe exercise of both.

## CHANGES IN PERSONNEL

### Staff Losses - 1945-46

Ballard, Hilda—Stenographer in Agricultural Engineering, September 15, 1945.

Bauer, George N.—Assistant in Agricultural Statistics, June 30, 1946.

Clark, Beatrice—Assistant in Agricultural Economics, February 16, 1946.

Coombs, Maxine (Mrs.)—Library Assistant in Charge Plant and Animal Science Library, January 14, 1946.

Eckman, Barbara (Mrs.)—Library Assistant in Charge Plant and Animal Science Library, January 8, 1946.

Eggert, Russell—Research Assistant in Horticulture. Left September 1, 1945, for Professional Improvement and later accepted position at Iowa State.

French, Jean—Laboratory Technician in Bacteriology, September 15, 1945.

Holley, Winifred D.—Research Assistant in Horticulture, September 15, 1945.

Horne, Grace—Stenographer in Poultry Husbandry, April 30, 1946.

Jones, Frangcon—Graduate Assistant in Bacteriology, January 31, 1946.

Jones, Richard—Research Assistant in Botany, June 30, 1946. To devote full-time to teaching in College of Liberal Arts.

Littlefield,, Willis E.—Purchasing Assistant, September 8, 1945.

McNeill, Mary V.—Stenographer in Agronomy, April 13, 1946.

Mackel, Harriet (Mrs.)—Laboratory Assistant in Bacteriology, June 30, 1946.

Sherburne, Virginia (Mrs.)—Stenographer in Agricultural Engineering, February 7, 1946.

### STAFF REPLACEMENTS AND ADDITIONS - 1945-46

Blickle, Robert L.—Assistant Entomologist, March 14, 1946.

Calahan, C. Lyman—Graduate Assistant in Horticulture, February 1, 1946.

Chagnon, Gloria—Stenographer in Agricultural Economics, July 1, 1945.

Colovos, Nicholas F.—Animal Nutritionist, January 1, 1946. (On leave April 5, 1946 — illness.)

Connor, Barbara—From Assistant in Research to Graduate Assistant in Home Economics, September 24, 1945.

Harwood, Wilfred T.—Library Assistant in Charge Plant and Animal Science Library. Returned after leave, June 17, 1946.

Hopp, Richard—Graduate Assistant in Horticulture, September 24, 1945.

Kalin, Elwood W.—Greenhouse Superintendent, December 6, 1945.

Miller, Ian—Graduate Assistant in Bacteriology, February 1, 1946.

Miller, Margaret (Mrs.)—Stenographer in Agronomy, April 17, 1946.

Piper, Edward—Field Assistant in Agricultural Economics, January 1, 1946-June 8, 1946.

Smith, Russell C.—Purchasing Assistant, September 1, 1945.

Spalding, Patricia (Mrs.)—Stenographer in Agricultural Engineering, February 11, 1946.

Swain, Lewis—Assistant Forester. Returned to Station work, November 1, 1945.

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100 Inheritance in Begonia Semperflorens - American Society for Horticultural Science - Vol. 46, 1945
101 Treatment of Bovine Mastitis with Penicillin - Journal of the the American Veterinary Medical Association - Vol. CVII No. 820, July, 1945
102 Observations on the Causes of the Flow of Sap in Red Maples - Plant Physiology, Vol. 20, No. 4

M. GALE EASTMAN, *Director*

# AGRICULTURAL CHEMISTRY

## The Carbohydrates of Pasture and Hay Crops As Related to Their Utilization by Cattle

Chemical analysis of the 23 samples (13 grasses and 10 legumes) obtained for this project is under way but the results and succeeding conclusions are not available at this writing. The technique or analytical procedure is consistent with the standard method used at this experiment station.

T. G. Phillips, T. O. Smith

## Study of Thiamine Assay Methods

Current activities concern the application of the previously proved procedure to various foods and biological fluids. Due to illness of the project leader the results are deferred for later publication.

A. E. Teeri

## Factors Affecting the Nutritive Value Of New Hampshire Grown Fruits and Vegetables

*I. The Effect of Quick-Freezing on the Vitamin Content of Strawberries.* Two varieties, Catskill and Howard 17, were procured from the same commercial grower as in the previous year. For a study of seasonal variation field samples were analyzed at the following times: the first picking, June 21; height of season, June 28; and last picking, July 5. For the effect of quick-freezing and storage on both varieties the berries were obtained from the height of season picking, June 28.

The data on the fresh berries show that the Catskill variety contains a higher content of ascorbic acid. Both varieties showed appreciable seasonal variation but with opposite trends. The Catskill started high and declined as the season progressed while the Howard 17 started low and increased at each picking.

| | Catskill | | Howard 17 | |
|---|---|---|---|---|
| Date of picking | Per cent moisture | Ascorbic acid in mg. per 100 g. | Per cent moisture | Ascorbic acid in mg. per 100 g. |
| June 21 | 90.6 | 61.3 | 92.8 | 32.3 |
| June 28 | 91.7 | 48.4 | 91.3 | 41.0 |
| July 5 | 89.2 | 50.1 | 89.4 | 48.3 |

Last year's various studies were all made on one picking (height of season) of Catskill berries, the fresh sample containing 90.5 per cent moisture and 49 *mg.* ascorbic acid per 100 grams (fresh weight). At that time three methods of freezing preservation were used: (1) in 50 per cent sugar syrup, (2) whole dry pack, (3) blanched prior to freezing whole dry pack. This year the following methods were used with Catskill: (1) whole dry pack, (2) in 40 per cent sugar syrup, (3) in 50 per cent sugar syrup, (4) whole-packed with dry sugar. Methods 1 and 4 were also used with Howard 17.

Blanching was discontinued because no apparent benefit was noted. The different sugar methods were added in order to further studies on the perplexing question as to why the sugar syrup preservation always shows such a high per cent of retention; at first (just after freezing) it is more than 100 per cent.

To eliminate errors caused by large losses in packaged weight noted during storage in the previous studies, all commercial containers were first paraffin treated. With this treatment losses for nine months were negligible while in former years they ran as high as 75 grams. This year the 50 per cent syrup pack contained 73.2 per cent moisture 12 hours after freezing and 73.0 per cent after nine months storage. The 40 per cent pack was 77.4 per cent and 77.5 per cent for the same periods. Last year, syrup packages lost from 10 to 12 per cent in moisture content over the same period.

During storage, the whole, unsweetened Catskill berries lost approximately 35 per cent of their original ascorbic acid, dropping to 31 *mg.* per 100 grams fresh weight. This is similar to last year when they changed from the original 49 *mg.* to 30 *mg.* over the same period. Comparable Howard 17 lost approximately 41 per cent. From the data this year it "appears" that Catskill berries packed in 40 per cent and 50 per cent syrups did not lose ascorbic acid during the nine months' storage. Similar results were noted with Catskill berries in dry sugar pack at the end of six months and for Howard 17 at the end of three months. There was some decrease in the dry sugar pack for both varieties after nine months, but the "apparent" ascorbic acid content was still higher than in the unsweetened berries of the same variety.

*II. The Effects of Canning and Quick-Freezing on the Vitamin Content of Blueberries.* No special study was planned for blueberries during the year. However, one box of each of the following varieties was delivered to the laboratory by a commercial grower of the state: Pioneer, Rancocas, Cabot, and Rubel. These were delivered in cellophane-covered berry baskets and were of the large cultivated type. Time between picking and analysis is unknown. Ascorbic acid was run on all samples and carotene was run on Rubel, since this variety was in the best condition when received. The results follow:

| | |
|---|---|
| Ascorbic acid: | |
| Pioneer | 1.3 to 3.3 *mg*/100 *g.* |
| Rancocas | 2.6 to 4.4 *mg*/100 *g.* |
| Cabo | 1.3 to 4.4 *mg*/100 *g.* |
| Rubel | 2.6 to 5.9 *mg*/100 *g.* |
| Carotene: | |
| Rubel | 60 *mcg*/100 *g.* |

*III. The Effects of Freezing and Dehydration on the Carotene Content of Blue Hubbard and Buttermut Squashes.* This year's work was planned to duplicate, if possible, last year's cold storage studies, because of the unexplainable high carotene values noted on those products. Due

to unforeseen circumstances, only commercial Butternut squashes were available, and facilities were limited to frozen storage. The samples this year appeared much riper and in better condition than those used previously. The fresh samples contained 15.3 per cent solids and gave values of 43 *mcg.* carotene per *gm.*, which is approximately three times higher than last year's carotene figures and one and one-half times higher than the previous year.

While blanching and chilling in distilled water preparatory to quick-freezing, total weight changes were studied, and it was noted that there was an increase of approximately 7 per cent over the original weight. At the same time moisture determinations on the fresh and blanched and chilled samples showed a loss of approximately 6 per cent of the original total solids. This loss was confirmed by analysis for solids of the water used.

The carotene values obtained for the blanched, chilled, and quick-frozen samples ranged from 45 to 50 *mcg/g.* with a solids content ranging from *12.1* per cent to *13.4* per cent. At the end of six months' storage the values ranged from 53 to 55 *mcg/g.*, with no change in the range of solids. In last year's total solids increased during storage from 15.7 per cent to 22.0 per cent over the same period. Because of this change in moisture content, paraffin-treated cartons were used this year for storage, which, in all probability, accounts for the stability of the moisture and solids figures, as noted above. The loss of total solids noted this year from the fresh to the blanched and chilled samples was also noted in last year's data.

*IV. The Effects of Canning (Home and Commercial) and Quick-Freezing on the Vitamin Content of String Beans.* Two varieties of green snap beans (Bountiful and Asgrow) were studied to determine the changes in ascorbic acid and carotene of the fresh and preserved products – frozen, home, and commercially canned. Marketable beans, grown locally on different farms, and used for fresh analyses and preserving, were all sized to eliminate errors due to maturity in the fresh state, and to permit a comparison of preserved packages. Each fresh sample consisted of 100 pods of any given size. The weight of this fresh sample varied with size, and the same size varied in weight within itself and with the season. Sized Bountiful beans picked July 23 varied in weight as follows: No. 1 - 271 *g.*; No. 2 - 496 *g.*; No. 3 - 748 *g.*; No. 4 - 918 *g.*; No. 5 - 1128 *g.*; No. 6 - 1255 *g.* Variations within a size were noted when size Bountiful No. 3, picked on August 21, varied as follows: 680 *g.*, 714 *g.*, 641 *g.*, 732 *g.*, and 690 *g.* Seasonal variation was noted when four pickings, at two-day intervals, of No. 4 Asgrow beans picked between July 26 and August 3 changed in weight progressively from 467 to 612 *g.* These beans were picked from a single planting on the Horticultural Farm.

For preservation studies, when more than one variety was used, samples were preserved only when they were of equal maturity. Asgrow bean No. 4, being a round bean, is considered to be of the same maturity as Bountiful No. 3, a flat bean, both reaching this sieve size 25 days from

anthesis.* For Asgrow No. 4, ,the fresh sample weighed from 467 - 698 *g.* and for Bountiful No. 3, from 641 - 748 *g.*

When fresh samples were analyzed for ascorbic acid or carotene, pH determinations were run (Beckman pH meter). For samples picked on July 23, the acidity was noted to decrease progressively with an increase in size (maturity) from pH 5.45 for No. 1 to 6.20 for No. 6. This is a five-fold decrease in acidity. This same trend in pH was noted (among sizes) on Bountiful beans picked August 21, and for Asgrows on July 28, July 30, and August 3.

The average ascorbic acid content of the fresh Asgrow and Bountiful snap beans, regardless of sizes studied, was practically the same, being within ± 6 *mg.* of 20 *mg.* per *gm.* fresh weight. In the preserving studies, when considering the total ascorbic acid in the container (water and solids), home-canned Bountiful No. 3 and Asgrow No. 4 each lost from 70 to 74 per cent during six months' storage. For the same period, commercially-canned Bountiful lost 48 per cent and Asgrow 65 per cent. For frozen samples, Bountiful No. 2 lost 72 per cent, No. 3 60 per cent, Asgrow No. 4 62 per cent and Asgrow No. 5 35 per cent. Processing caused the largest proportion of these losses in home-canned and freezing, whereby Bountiful beans lost 70 per cent in home canning and 36 per cent in freezing. In Asgrows the losses from home canning amounted to 42 per cent and from freezing 32 per cent. Processing of the commercially-canned beans caused the least loss of any method; 13 per cent for Bountiful and 22 per cent for Asgrow. During the course of the study it was noted in both commercially-canned and home-canned samples that after the first diffusion of the material into the liquids there was a relatively small change in the total ascorbic acid content of the liquids during storage in comparison to the large changes in the ascorbic acid content of the solids. The amount of liquid in the commercially-canned containers is always practically the same, but it is difficult to regulate the amount in the home-canned jars; therefore, no exact comparison can be made between a jar and a can, or between jars, except on total amount of ascorbic acid per package. While conducting these studies pH determinations were run on some of the products. For five processings (14 samples) home canning and freezing caused an increase in acidity, in some cases as high as 3.2 times the original acidity, while in two samples frozen for six months the acidity was decreased beyond the original pH, the decrease amounting to twice the acidity when being processed.

All samples of fresh Asgrow No. 4 beans, one of which was frozen, contained more carotene than the one fresh sample of Bountiful No. 3 which was preserved. The Asgrows ranged from 1.2 to 2.2 *mcg.* carotene */g.* while the Bountifuls ranged from 0.8 to 0.9 *mcg/g.* Processing, previous to all three types of preservation, caused an apparent increase in the carotene content of both varieties. In the Bountifuls, the apparent increase was greater in the home- and commercially-canned samples (ranging from 3.4 to 3.9 *mcg/g.*) than in the frozen pack (ranging from 2.2 to 2.7 *mcg/g.*) The carotene content of either variety of stored beans

*C. H. Mahoney *et. al.*, Am. Soc. for Hort. Sci., vol. 41, 1942.

was not altered during six months' storage, regardless of method of preservation.

S. R. SHIMER, H. J. PURINTON, M. E. LOUGHLIN

## AGRICULTURAL ECONOMICS

### Land Titles

In co-operation with the Bureau of Agricultural Economics, a study of deed descriptions was undertaken and completed. Deeds were examined in three register of deeds' offices. Land owners and officials were interviewed.

Descriptions of most deeds to rural land in New Hampshire were found to be vague. In areas where property lines are not regularly maintained, the description would not help much in actually locating boundary lines. The descriptions were of four types:

1. Based on names adjoining property owners
2. Same as above except that a few physical landmarks are added
3. Same as above except that general directions are given
4. Engineer's description

(In the first three types there was usually vagueness of the point of origin.)

Five basic requirements for changing to better descriptions were suggested:

1. Definite point of beginning
2. Each point described clearly
3. Terminology and measurements must be universal
4. Changing characteristics should be omitted
5. Must be identical with adjoining property

The following recommendations were made:

1. The towns with special property maps should consider their use in conveyancing.
2. Towns could file maps with register of deeds to show approximate location, shape, and size of property.
3. Purchasers in towns having maps should see that descriptions are adequate.
4. Permanent markers should be put in where possible.
5. State-wide co-ordinate system should be legalized. This would eventually provide a means of accurately locating the point of origin of a deed description.

J. C. HOLMES

### A Study of the Supply and Distribution of New Hampshire Milk

*1. Every-Other-Day Delivery of Milk.* In the summer and fall of 1945, a study was made to determine the effect of war-time practices, particularly every-other-day delivery of milk, on the efficiency of retail and wholesale milk distribution.

Data were obtained from 19 distributors in the Merrimack Valley for the month of July, 1941, a period preceding the change from daily to

every-other-day delivery, and for the month of July, 1945, when the new practice was in effect. Comparisons were made between the two periods in the labor cost, the output per worker, and the miles of truck travel.

The 10 large distributors, those handling over a thousand quarts daily, had expanded their total physical output as measured in quarts by 31 per cent in the four-year period. This greater volume had a large influence on costs. The output per retail routeman increased 27 per cent and the average weekly earnings of routemen increased 48 per cent. The large wage increase was partially offset by greater output per man and the labor cost of distribution per quart on routes had increased only 16 per cent.

With the small distributors, output per man on retail routes increased 28 per cent; but because the operators of these small plants personally took an active part in the actual distribution the costs were not determined. The weekly earnings per man hired went up 27 per cent.

Truck travel per unit of output on retail routes decreased 49 per cent with the large distributors and 55 per cent with the small distributors under the every-other-day system.

On wholesale routes of the large distributors the output per worker increased 32 per cent and weekly earnings per worker increased only 5 per cent, resulting in a lower labor cost per unit.

It is difficult to compute the additional cost that would be involved if we return to the practice of daily delivery. Due to greater total volume now, it is doubtful if the industry would return to the situation existing in 1941. Some of the savings in efficiency of greater volume per worker might be retained. It is evident from the study, however, that additional costs in distribution are involved if the industry returns to daily delivery of milk.

*II. Milk Trucking in Colebrook Milkshed.* Data were collected in July, 1945, from three milk plants and from truckers and others concerning the operation of the Colebrook milk trucking re-organization plan. Fewer operators were producing more milk. Since this had been the trend for several years the great volume had placed an additional burden on the trucking equipment available and also on the plant facilities. However, in 1945, very little difficulty was experienced in meeting the health regulations concerning the delivery of all uncooled milk before 10 A.M.

Because all the producers on two long routes had installed cooling equipment, these routes could deliver milk after 10 A.M. Moreover, self-haulers and short-route trucks were coming in earlier, leaving more time for the unloading of long-route trucks. These changes solved the difficulties experienced in the previous year.

The 18 main routes had not changed materially during the year except that a larger total weight of milk was carried from fewer producers. Against this creditable operation on main routes, more individuals were handling their own milk. Twenty self-haulers, in 1944, traveled about 102 miles daily to deliver 9319 pounds of milk. In 1945, 27 self-haulers were traveling 164 miles to deliver 12,194 pounds of milk. Approxi-

mately 72 miles of daily travel could be eliminated, if the operators put their product on available routes. After making due allowance for extra mileage required for pick up of milk in new areas, the trucking pattern showed 721 miles in July, 1945, as compared to 852 miles in 1942, a saving of about 15 per cent. There was little change in rates during the year.

H. C. Woodworth, J. C. Holmes

### Changes in Income of Dairy Farmers

A procedure was developed this year to measure roughly the changes in income of dairy farmers. Financial information was secured from a random sample of 45 commercial dairy farmers as to the cash operating costs and cash receipts for the year ending December 31, 1944. The cash receipts averaged $5,546 in 1944 and the cash expenses, not including interest but allowing for depreciation, were $4,208. This left a farm income of $1,338 which represents the returns for both family labor and the investment in the farm, equipment, and livestock. Having established an estimate of farm income for 1944, there data were made the basis of statistical estimates for other years.

Seven items represented 98 per cent of the total receipts and a series of relative values were set up for each of the seven items covering the years under consideration. These relative values were computed independently of each other and were based on the random sample of wholesale farms, publications of the U. S. Department of Agriculture, including the various reports of the Crop Reporting Service, and price lists of the Merrimack Farmers Exchange and the Eastern States Farmers Exchange. Similarly, a series of relatives were set up for the major items of expense. These data were the basis for determining the farm income each year from 1939 to 1945 and can be the basis for computing an estimate of income of dairy farmers from year to year. The dairy farm income estimated under this procedure was found to be as follows:

| Year | Farm Income |
|---|---|
| 1939 | $ 230 |
| 1940 | 422 |
| 1941 | 474 |
| 1942 | 708 |
| 1943 | 941 |
| 1944 | 1338 |
| 1945 | 1539 (Preliminary) |

This does not include value of products from the farm.

G. N. Bauer

### Developing Home and Market Outlets

The development in frozen foods and the use of locker plants and home freezers have been emphasized.

*Many Home Freezers In Use.* Many home freezers were built during and since the war. With commercial boxes again available, many

will prefer to buy them, but farmers often want large or walk-in type boxes which are expensive or difficult to move into the location desired.

A number of home freezers in which meters were placed have proved economical. Three boxes, ranging from 30 to 60 cubic feet, used from 805 to 1249 kilowatts of electricity per year, or an average of 24.1 *k.w.* per cubic foot, which, with a rate of 2.5 cents, would cost 60 cents per cubic foot per year. Assuming 40 pounds of food storage, the electrical cost would be 1.5 cents per pound.

The cost of eight homemade boxes of from 30 to 65 cubic feet of storage space (exclusive of owner's labor but including installation of the refrigeration unit) ranged from about $290 to $490, and averaged $380 for 42 cubic feet, or about 35 per cent as much as O.P.A. price ceilings announced on a number of commercial boxes of similar size.

*Utilization of Freezer Storage Space.* In three plants, the 20 per cent of locker holders using space most efficiently processed more than 11 times as much food as the 20 per cent of holders using the space least efficiently. This upper group showed combined locker and processing costs of three, four, and eight cents per pound, and they processed 34, 46, and 57 pounds per cubic foot of space, respectively, in the three plants. Eighteen per cent of the locker holders in five plants held more than 11 cubic feet of storage space. Holders of large lockers use their space less well than small locker holders. In one plant those with six cubic feet of space processed twice as much per cubic foot as those with 20 cubic foot of space.

In seven plants one-sixth of the patrons held more than one locker and had about one-third the total space.

*Processing Fruits and Vegetables.* Few locker plants process fruits and vegetables. They are not generally equipped and operators consider such processing unprofitable. Small lots of various products do not lend themselves to processing by expensive labor-saving machines. The few plants that have processed small amounts of berries and peaches for sale encounter high costs. Prices of fresh peaches and berries in this area usually are very much higher than in processing areas.

Lack of sugar and high prices have discouraged freezing fresh fruits for sale. Most vegetables require special equipment, and neither farmers nor locker plants have been prepared to process them. However, more information is needed on such products as sweet corn and beans now produced for canning factories.

*Home Freezer Prices.* Average ceiling prices on 169 models of 69 makes of home freezers ranged from $22.06 per cubic foot for those within the range of 48 to 54 cubic feet, to $55.84 for those under six cubic feet. The average for all was $31.50 per cubic foot. Eight homemade boxes averaged about $9.00 per cubic foot exclusive of owner's labor but including installation of the refrigerator unit and purchase of the unit and supplies at retail. The addition of 100 hours of labor at $1.25 would bring the cost up to $4.80, or less than half the average ceiling price on a commercial box of similar size. Purchasers are likely to get better values

in boxes once competition is fully under way and many makes are readily available.

*Home Freezers vs. Lockers.* Meats make up a large part of the volume of processing done by locker plants, and operators expect to hold most of this business even though home lockers are built or purchased. But the home freezer is ideal for small lots of fruits and vegetables which come from the home garden throughout the season.

Home box owners compared favorably with the upper one-fifth of the locker holders at several plants with respect to amounts of food processed, but they processed about five times as much of fruits and vegetables. They also had a much greater variety. While home box owners may be "freezing enthusiasts" the convenience factor was an important one in fruit and vegetable processing. Home freezer storage will play an important part in increasing the amount and variety of frozen foods used on the farm table. The cost of home freezer space still greatly exceeds that of locker space. Nevertheless, large numbers of people will purchase home zero storage when the costs of such storage decrease, as seems probable.

*Freezer Locker Holders.* Data on 5,295 locker holders in 20 plants show patronage consisting of 52 per cent farmers or part-time farmers, and 48 per cent non-farmers. More detailed data on 3,892 locker holders in 14 plants show 39 per cent farmers, 14 per cent part-time farmers, and 47 per cent non-farmers.

*Locker Plant Gross Income.* Data from four locker plants showed gross income as follows:

| | |
|---|---|
| Lockers and storage | 37% |
| Processing | 30% |
| Frozen food sales | 16% |
| Meat, supplies, and miscellaneous | 17% |

Many plants are putting in display cases and adding to the variety of foods sold. Frozen food and meat sales may increase in the period ahead.

L. A. Dougherty

## CROPS

### Potato Experiments in Northern New Hampshire

Potatoes were grown on Coffin field No. 2 at Colebrook during 1945 and are produced again this year under the following treatments: with one ton of 5-10-10 fertilizer as a standard; 10 tons manure, 1,000 pounds ground limestone; 500, 1,000 and 2,000 pounds of gypsum, magnesium; in two rates, five and 20 pounds of borax per acre; and with the sulphate of potash substituted for the chloride. Since yield data are available for only one year they are not presented here.

Potatoes grown under the various treatments were subjected to the specific gravity test for quality. Tubers grown with the sulphate instead of muriate of potash proved to have a slightly higher quality rating than

those under any other treatment. Since the basic fertilizer of all other treatments included chloride, it would seem that the chlorine content of the fertilizer depresses the starch content of the tubers. This theory is substantiated by greenhouse trials.

The Green Mountain variety was grown in the field tests in 1945. Due to a severe outbreak of aphids, and in spite of the use of DDT during the season in which the aphids were active, there was a great deal of late season spread of leaf roll with subsequent development of net necrosis.

It was thought that the use of sulphate of potash, or one of the rare elements applied, might possibly reduce the amount of net necrosis in the crop. Such was not the case, however, since an examination of approximately 500 tubers from each treatment showed no significant differences for the various treatments.

Experiments were carried out during the 1945 season with different methods of applying fertilizer. In one test, all of the fertilizer was applied with the planter and contrasted with plowing all of it under. In another series of plots, half of the fertilizer was applied with the planter and half was plowed under. For those plots on which all of the fertilizer was applied with the planter, the yield was slightly better than when part or all of the fertilizer was plowed under. Yield differences were slight, however, and since total yields in all cases were small, it is doubtful if the differences, which amounted to about 12 bushels per acre are significant.

The effect of fertilization upon quality of Green Mountain potatoes were tested in field plots at Northwood Ridge. The fertilizer variations involved deviations from a normal 5-10-10 fertilizer, and included omission of P and K from the formula, doubling of the P or K content of the formula, the omission of chloride from the formula, and the addition of Ca and S in the form of gypsum.

These field trials showed that tubers from the low chloride or no chloride treatments had a higher quality rating than those from the treatments which contained chloride. The average quality ratings were respectively 94.4 and 88.5 for the two groups, or a difference of approximately 1.18 per cent starch in favor of the low or no chlorine treatments. Extra phosphorus to give a 5-20-10 formula whether added as 20 per cent superphosphate or as 43.8 per cent superphosphate tended to increase the quality rating. Extra potash to give a 5-10-10 formula increased the quality rating from 92.2 to 95.9 when $K_2SO_4$ was used, but decreased the quality rating from 88.4 to 85.1 when KCL was used.

Greenhouse experiments involving a study of the influence of calcium, sulphur and chlorine upon the yield and quality of Green Mountain potatoes showed that an adequate supply of calcium and sulphur were essential to good yields and good quality, whereas chloride had a slightly adverse effect on yield of tubers, and a strongly adverse effect on the quality rating of the tubers, but a slightly stimulating effect on the growth of tops.

F. S. PRINCE, P. T. BLOOD, L. T. KARDOS

### A Dairy Farm Rotation in Southern New Hampshire with Sweet Corn as a Cash Crop

Current activities involve methods of application of fertilizer rather than the usual fertility variations studied previously. The plan involved: (1) a series of plots on which all of the fertilizer was plowed under; another series on which half was plowed under and half applied with the planter; (3) a third series on which 700 pounds were applied with the planter and 500 pounds were side-dressed at the second cultivation; and a fourth series on which all the fertilizer was applied with the planter. Twelve hundred pounds of 5-10-10 fertilizer were used in each series.

The corn yields (green ears per acre) follows:

| | |
|---|---|
| All fertilizer plowed under | 6.85 tons |
| Half plowed under, half applied with planter | 7.26 tons |
| 700 pounds with planter, 500 pounds side-dressed | 7.41 tons |
| All applied with planter | 6.17 tons |

Plot observations during the growing season indicated that plots on which the fertilizer was all applied with the planter made more growth early than those on which the fertilizer was plowed under, were taller at midseason, but yielded .68 ton less at harvest. There were no other apparent differences. The plots on which all the fertilizer was plowed down yielded .41 ton less than where half was plowed down and half applied with the planter but the highest yield was secured by applying part of the fertilizer as a side dressing.

The season of 1945 was one of relatively heavy rainfall, a condition probably favorable to side dressing and unfavorable for plowing fertilizer under.

F. S. PRINCE, P. T. BLOOD

### The Relation of Potash Levels To the Persistence of Clover in Hay Stands

Yield data and botanical analyses of the two series of plots harvested in 1945 are completed. Plots 1-46 were seeded with red clover and timothy, in 1942. All plots, except those to which borax was applied, received an annual application of superphosphate and nitrate of soda. Manure was applied only at seeding time in two levels, 10 and 20 tons per acre. Potash was applied annually in the muriate form at levels of 100, 200, and 300 pounds. All treatments increased the yield over the check averaging about 1000 pounds per acre. The highest yielding series was the one receiving borax.

Lack of variations in yield for potash levels is undoubtedly due to winter-killing of clover in the winter of 1943-44 and perhaps in part to annual applications of nitrogen which appear to be inimical to clover volunteering into the stand. The slight variation in percentage of clover on the potash plots is probably not significant.

The other series (plots 47-80) present a much more interesting history and a wider range of data. These plots were seeded in 1937, and have been harvested each year since. Data for the first four years were published in Station Circular 61.

Those plots which were treated with potash each year since seeding outyielded the current series about 700 pounds of cured hay per acre. In a similar comparison, the PK and NPK plots with the corresponding treatments of 0-20-20 and 8-16-16 fertilizer respectively, the PK outyielded its counterpart by almost 1500 pounds per acre, and the NPK outyielded the 8-16-16 by 1600 pounds per acre. The results favor adequate annual top-dressing each year during the life of the stand, so that desirable plants responsive to fertilization will be retained.

The second point of note is the effect on yield where superphosphate and potash are used together in contrast to the use of potash alone. As a four-year average, the PK plots yielded a little over a ton more per acre than those which received potash alone. Furthermore, the percentage of clover in the plots treated with phosphoric acid and potash without nitrogen were high, the actual percentages being 49 and 34 in the PK and 0-20-20 plots respectively, whereas in the complete fertilizer plots the percentages were but 9, 10, and 20 respectively. This indicates an unfavorable effect of nitrogen on the persistence or appearance of clover in old hay stands and may foreshadow a change in recommendations for hay top-dressing grades from the 1-1-1 ratio now in use or the 1-2-2 ratio used in this test to one with a much wider N to PK ratio or even one with no nitrogen at all.

F. S. PRINCE, P. T. BLOOD

## Seed Production Possibilities of Forage Crops

Seed production possibilities of timothy, red clover, and Ladino clover have been investigated. In addition to the methods of handling and of yield possibilities, the experiment involves multiplying certain new clover and timothy strains that have developed in the breeding program. Two strains of timothy, four of red clover, and one of Ladino were threshed.

Timothy was harvested with a 40-inch AC combine in the field. Red clover was cut with a mower and windrower attachment, then allowed to lie on the ground until curing was fairly complete. It was then threshed with the AC 40-inch combine equipped with a pick-up attachment.

Ladino was cut with a windrower and dried indoors. This method of drying did not prove satisfactory as the quantity harvested was too large to cure properly in the space available. Unused greenhouse benches proved to be the best place for indoor drying; the germination of the seed produced is better than when the drying was slower in a house under a roof. After drying, the Ladino foliage was run through a hammermill and then cleaned with an old clipper fanning mill. Cleaning the Ladino seed has been finally completed by using the rotary scour-kleen sieve of the combine.

Field data are not complete since not all the seed has been re-cleaned, but preliminary estimates indicate that the acre yield for the three crops

are about as follows: Timothy 140 lbs.; red clover 100 lbs.; and Ladino clover 50 lbs.

F. S. PRINCE, P. T. BLOOD, L. J. HIGGINS

## Variety Trials of Oats and Other Small Grains

*Oats.* Thirty varieties and strains of oats were planted, May 7, 1945, at the Bunker Farm. Each lot was replicated three times in randomized rod rows spaced two feet apart. Twenty-six varieties were furnished by the United States Department of Agriculture and four more were added later since they had shown some promise in previous trials. The standard "checks" were Lenroc, Erban, Victory, and Upright. Of them only Erban shows any disease resistance.

The oats were cut by hand from August 7 through August 14, depending on proper ripening. Each row was weighed immediately to get the forage yield. Then the grain was threshed out by a header. The grain was bagged, dried, and cleaned in the laboratory.

The 1945 variations in yield were greater than in 1944 but not so great as in 1943. 1945 was a medium-disease year but disease was less prevalent than in 1943. There was enough disease present to show the advantage of growing disease-resistant varieties.

Forage weights are not too reliable since they are not dry weights and there are differences in maturity. However, they give indications of high-yielding forage sorts. This is important since many acres of oats are cut green for forage purposes in New Hampshire.

*Barley.* Fifteen barley varieties were grown in three replications each day with the oats. The barley replications were handled in the same manner as for oats. Wisconsin Barbless (No. 38), Alpha and Velvet were used as standard checks. A new variety, Swiss No. 87, was outstanding in all replications. The two Canadian varieties, O.A.C. 21 and Byng. once again yielded high.

*Spring Wheat.* Twenty-one varieties of spring wheat were grown in rod rows for grain. As in 1944, Frosteira, a rather late maturing sort, led in yield. Henry, which stood second in 1944 ranked fifth in 1945.

L. J. HIGGINS

## Experiments with Small Grains in Northern New Hampshire

As in the past, there were no oat diseases which depressed the yields of non-resistant varieties with the result that high yields were secured with some of the old varieties regardless of breeding. Among these were Upright and New Victory which are disease-susceptible and ranked second and third, whereas Vicland and Clinton, two popular disease-resistant sorts, ranked thirteenth and fourteenth, in 1945.

As a result of these experiments, seed production has been started in the area with Vanguard and Ajax, two Canadian varieties which have shown up well over a period of years. Both of them are good producers of seed and grow tall enough so that farmers do not discriminate against them for forage purposes. Since oats are grown in the area for both

forage and grain, it is doubtful if the short strawed varieties will ever become popular with the farmers as a whole.

F. S. PRINCE, P. T. BLOOD

## Silage and Field Corn Trials

*1945 Silage Corn.* Thirty varieties and hybrids were planted on May 25, 1945, at the Bunker Farm. Each seed lot was replicated three times in 18 hill rows with each hill thinned to three plants. West Branch Sweepstakes, a high-yielding, open-pollinated variety, and Cornell 29-3, an excellent double-cross hybrid, were used as the standard checks.

On September 12, 1945, the corn silage was harvested. Twelve hills of each replication were weighed for the calculation of the green weight acre yield. One hill of three plants of each replication was bagged and dried to obtain, on a uniform basis, the calculations of the yield of dry matter per acre.

In this tenth year of silage trials, both West Branch Sweepstakes and Cornell 29-3 gave good returns. Massachusetts 62, a new hybrid, showed considerable promise. Due to one poor replication, Ohio K-24, well up a year ago, dropped down.

*1945 Grain Corn.* Forty varieties and hybrids in three replications of each were planted, May 25, 1945, at the Bunker Farm. Each replication was made up of 18 hills and each hill was thinned to three plants. The standard checks were as follows: two local unnamed Flint varieties, two Dent Flint hybrids (Maine "A" and Maine "B"), and two Dent varieties (Cornell 11 and New Hampshire 500).

The ears were snapped off on October 19 and 20, 1945, and the weights of each replication yield were recorded. Four ears were selected at random from each replication for drying down to a uniform moisture content. The uniform moisture basis was used for calculating the moisture loss and yield per acre of grain.

In the 10 years that the grain trials have been conducted, certain Michigan, Minnesota, and Wisconsin hybrids have stood out. Cornell 29-3 has given a good account of itself both for grain and silage. Massachusetts 62, a new hybrid, gave the best yield of grain for the 1945 season, and stood fourth for silage.

The 1945 season was a poor corn year and the resulting data are quite unreliable. Due to a cold and wet spring, the planting was late and the stand was not uniform. Furthermore, rodent damage was the worst ever experienced.

L. J. HIGGINS

## Introducing New Potato Varieties for Certified Seed

During the 1945 season, the Mohawk variety of potatoes was introduced and planted as tuber unit stock in the Colebrook area. This variety was chosen because of its excellent cooking quality since it was hoped that it might serve as a replacement for the Green Mountain, a variety which is losing popularity because of its susceptibility to net necrosis.

The season was characterized by a severe outbreak of aphids; in spite of having an ample supply of DDT dust to apply, considerable leaf roll was spread into the one and one-half acre block late in the season. Winter greenhouse trials on the tubers from which the vines were killed early showed six per cent leaf roll, which was too heavy an infection for use as foundation stock. Since the variety shows some net necrosis and since, from this first year's test, the variety appears to be leaf roll susceptible, there is some question as to whether or not work should be continued with the Mohawk. A half-acre block is being tuber-united this year and the vines will all be killed early, in the hope that leaf roll can be controlled.

Tuber unit work has been started with two other varieties new to New Hampshire; Pawnee, a promising mid-season variety, and Ontario, a scab-resistant variety. These are being grown at Durham, in sufficient volume to multiply into large blocks in the Colebrook area in 1947.

In addition to the tuber unit work, 18 varieties of potatoes were grown in 1945 in properly replicated plots in Madbury. A tabulated summary has been made of yields of No. 1s and No. 2s together with a count of the number of rotten tubers. Many of these were too badly decayed to weigh; therefore, the weight was not tabulated.

There was much variation in total yield as well as in the yield of No. 2 potatoes. Mohawk and Pawnee ranked third and fourth with respect to yield. Mohawk showed a very low weight of No. 2 potatoes and Pawnee exhibited no rot. The Ontario was not included in the 1945 tests.

Some of the less promising varieties have been dropped in 1946; but new ones have been added so that there are 28 varieties growing in the current season's tests. Eight of these are new strains that have been produced by plant breeders and are supposed to be resistant either to leaf roll or late blight.

In addition to the yield and other data, all the varieties were tested for "quality" by the specific gravity method.

P. T. Blood, M. C. Richards, L. T. Kardos,
L. J. Higgins, F. S. Prince

## Proper Construction of Farm and Commercial Potato Storage

Preliminary results, in 1945, indicated that carbon dioxide could be used to retard the sprouting of potatoes at normal storage temperatures as the latter increased to a value of 62°F in July.

The gaseous storage of potatoes was studied further and compared with a hormone type of sprout retardant. Carbon dioxide and oxygen concentrations were varied and the tubers were held at a constant temperature, approximately 53°F. The gaseous concentrations were within the range of from less than one per cent to slightly more than 10 per cent $CO_2$ with the latter supplied in part or wholly by the respiration of the tubers. The hormone used was the methyl ester of alpha naphthalene acetic acid, and was applied in the form of a dust with 0.45 and 0.90 grams of ester per bushel of tubers. Katahdin tubers, free from cuts and bruises, were used and the duration of the trial was from March 18 to May 6. At the close of the experiment, the loss in weight of the tubers, degree of

sprouting, starch content by specific gravity test, and cooking quality were determined.

The cooking quality was not adversely affected. The carbon dioxide storage of potato tubers appears to be fully as effective as the hormone treatment in preventing sprouting of potatoes when storage temperatures are equivalent to those normally occurring in May and June. Unknown effects of the hormone residues on human physiology and on taste of the tubers would be eliminated. By retardation of sprouting the potato grower would have a longer season in which to market his table stock; and seed stock may be prevented from excessive sprouting when the planting season is retarded by unfavorable meterological conditions. Further study on the persistence of retardation of sprouting after removal from the gaseous carbon dioxide storage will be necessary before its use with seed stock can be recommended. At present, there is an indication of a moderate tendency for the sprout retardation to persist. Larger scale bin experiments are planned for the next storage season.

P. T. BLOOD, L. T. KARDOS

## DAIRYING

### The Relation of Trace Minerals to Vitamin Synthesis in the Rumen of Dairy Animals

Work on this project was seriously handicapped due to cessation of chemical analyses necessitated by temporary leave of absence of one or the personnel.

Exploratory investigations were made on two animals with reference to methods and technique of obtaining representative samples of rumen content. On the basis of preliminary observations, there is evidence that samples secured via a rumen fistula are not sufficiently typical of normal rumen contents to be entirely satisfactory for an accurate routine analysis when determining such as ascorbic acid, thiamine, riboflavin, and nicotinic acid. It is difficult to prevent some loss of rumen fluids and gases, as well as to avoid introduction of air into the rumen. These abnormal changes may logically influence the accuracy of analytical results.

For the purpose of the particular analysis involved, some preliminary work using a stomach pump indicated that such a method may be more satisfactory than a rumen fistula for securing representative samples of rumen content.

K. S. MORROW, H. A. KEENER, A. E. TEERI

### Cobalt Treatment of a Nutritional Disease Of New Hampshire Cattle, Sheep and Goats

A nutritional deficiency responding favorably to the feeding of cobalt has been found to be wide-spread throughout most of the state, and has incurred heavy financial losses to the livestock industry for a period of many years. This deficiency has been produced experimentally in a paired experiment with sheep, using a New Hampshire hay which was deficient in cobalt. Studies have been continued to determine the

tolerance of cattle to the daily intake of cobalt. Results to date indicate that amounts normally used by feed manufacturers are well within limits of safety.

Plant work includes a comparison of the cobalt content of alsike clover and timothy grown on soils of granite and calcareous parent material. Both clover and timothy grown on calcareous soil contained more cobalt than plants of the same species and stage of maturity grown on a soil of granite origin. In both cases, the clover contained considerably more cobalt than timothy grown on the same soil, indicating another superiority of clover. Soil studies indicated a strong relationship between cobalt deficiency and the kind of rock from which the parent soil materials were derived.

H. A. Keener, G. P. Percival, K. S. Morrow

## Dry Rations for Raising Dairy Calves and Heifers

The major phases of this project as originally outlined have been completed. During the year, however, an analysis was made of the data concerning the values of several blood constituents of calves under five months of age. The components studied were carotene, ascorbic acid, nicotinic acid, calcium, phosphorus, glucose, cholesterol, and non-protein nitrogen. Guernsey, Holstein, and Jersey calves were used in the study.

Considerably lower values were obtained for plasma carotene with Holsteins than for either of the other breeds. Breed differences with respect to ascorbic acid values were not significant for calves of the age range studies. There was no correlation found between age and blood calcium and phosphorus; on the other hand, blood glucose showed a definite decrease with age. Cholesterol values tended to parallel the results found for glucose, those of the greatest magnitude being in the youngest age group. Non-protein nitrogen values were in good agreement with those reported for older animals in other studies. As for the nicotinic acid results, extensive data are lacking in the literature with which to make comparisons, although the values secured in this study can, when supplemented by further investigations, be of considerable significance in the establishment of what might be considered the normal range of values for this vitamin in the blood of calves.

Normal growth curves, based on month and season of birth, are being prepared from growth data on 250 calves raised in the University dairy herd.

K. S. Morrow, H. A. Keener, A. E. Teeri

## The Effect of Vitamin D on the Metabolism And Utilization of Energy and Protein by Calves

The effect of Vitamin D on the utilization of protein and energy was studied on two groups of Holstein calves. Each group consisted of two deficient animals and a control animal which was fed 1000 U. S. P. units of Vitamin D per 100 pounds of body weight per day by means of irradiated yeast. The basal ration consisted of skimmilk, a low Vitamin D concentrate mixture, and dried beet pulp as the roughage. Nitrogen

and energy balances were run on each group after definite deficiency symptoms were observed in the animals not being fed supplemental Vitamin D.

A significant difference in the utilization of protein or energy was not detected by means of "balance" studies. However, some of the deficient animals were so rachitic that they would not consume a normal amount of feed while "balance" studies were in progress. This may have masked any differences which otherwise would have been observed had they been eating normally. Although the balances showed negligible differences, growth studies showed a greater and more efficient gain by both animals which received supplemental Vitamin D as compared to the deficient animals.

N. F. COLOVOS, H. A. KEENER, E. G. RITZMAN

### Nutrition Studies with Lactating Cows

In this study it was planned to include the determination of digestibility and utilization of the protein and energy of Ladino clover pasture by milking cows.

Various stages of growth were to be used in different experiments as plant growth permitted. Because of adverse weather conditions, however, the Ladino clover was killed out to such an extent during the spring months that such experiments were not possible during the early part of 1946.

N. F. COLOVOS, H. A. KEENER

### Determination of the Ratio of Solids-not-Fat In Milk Produced by Cows in Different Family Lines

Solids determinations were completed on milk from those cows in the University herd that did not have two previous lactation records.

Of the 22 sires on which records are now available, six lowered milk production, increased fat percentage and solids-not-fat percentage; five increased milk production and fat percentage but lowered solids-not-fat percentage; three increased milk production, fat percentage, and solids-not-fat percentage; three increased milk production and lowered both fat and solids-not-fat percentage; two increased milk production and solids-not-fat percentage but lowered fat percentage; two lowered milk production and solids-not-fat percentage but increased fat percentage; and one lowered milk production slightly and lowered the fat percentage but increased the solids-not-fat percentage.

H. C. MOORE, H. A. KEENER

### Relationship of the Composition of Milk To Methods Used for Determning Adulteration

Progress on this project was seriously retarded due to temporary leave of absence of one of the personnel. Some work was done on standardizing methods, although no actual experimental results were obtained with individual cow samples or field samples. Solids analyses were continued on cows in the University herd on which records for two lacta-

tions had not been completed previously. Three more sires were proven on the bases of this additional data.

H. C. MOORE, H. A. KEENER, A. E. TEERI

## Efficient Chore Practices in Dairy Barns

The detail milking records taken on New Hampshire farms during the last two years were carefully studied and analyzed. The better methods and practices of each phase of the task were noted and these several parts of the job were fitted together and then time patterns for the total task of milking were projected. This required the development of definite assumptions as to what tasks were essential, how much time would be required for each, and the sequence timing of each one.

In making these assumptions and in allocating time for the separate tasks, the results were regarded as preliminary because there are uncertainties as to what is essential in good milking. The wide differences between farms in the time required to milk cows under the rapid milking procedure can be accounted for in large part in the general approach and the sequence and timing of the practices, and so in the analysis these phases of the problem were emphasized.

It was assumed that cows could be milked out on the average in 3.5 minutes machine time. This was based on an analysis of the detailed records taken on selected farms where milking was efficient. The distribution of 693 cows in 31 herds time required to machine milk is indicated below according to minutes required for machine milking:

| Machine Minutes | Number of cows | Per cent of cows | Per cent of total time | Average time |
|---|---|---|---|---|
| Under 3.0 | 279 | 40.3 | 30.4 | 2.54 |
| 3.1 to 3.5 | 164 | 23.7 | 23.4 | 3.33 |
| 3.6 to 4.0 | 127 | 18.3 | 20.9 | 3.83 |
| 4.1 to 4.5 | 68 | 9.8 | 12.5 | 4.29 |
| 4.6 to 5.0 | 26 | 3.7 | 5.3 | 4.75 |
| 5.1 to 5.5 | 11 | 1.6 | 2.5 | 5.35 |
| 5.6 to 6.0 | 10 | 1.4 | 2.5 | 5.78 |
| 6.1 to 6.5 | 2 | .3 | .6 | 6.40 |
| Over 6.5 | 6 | .9 | 1.9 | 7.30 |
| | 693 | 100.0 | 100.0 | 3.36 |
| | (If cows requiring 5 minutes are eliminated) | | | |
| | 664 | 95.7 | 92.5 | 3.25 |

Most of the cows in these herds were hand stripped and some allowance was made in the assumption of 3.5 minutes per cow for machine stripping. Many dairymen would have to do some selection of cows on the basis of ease of milking in order to attain the goal of 3.5 minutes. Other assumptions were (1) .3 man minutes to change the milker from one cow to another including the disposal of the milk; (2) .3 man minutes to prepare the cows; (3) .5 man minutes to machine strip each cow; (4) one minute to carry the milk from each two cows to the milk room.

Under these assumptions, time patterns were made up for the following combinations of men and machines:

1 man and 2 single units
1 man and 1 double unit
2 men and 3 single units
2 men and 2 double units
2 men and 4 single units

The time patterns indicated that one man with two single units or one double unit could milk 20 cows in approximately 42 minutes which is 2.1 man minutes per cow. These time patterns were then checked on selected farms where previous milking records were good. Several of the operators approached the pattern in total time. For instance, one man milked 18 cows in 37.5 man minutes and another milked 25 cows in 62 minutes. The first is at the rate of 2.1 man minutes per cow and the second 2.5 man minutes.

When the details of these actual milking records are placed on charts and compared with the time pattern, the possibility of improvement in timing the practices and in milking more efficiently is apparent. For instance, the operator with one double unit followed a definite pattern in milking but prepared the cows too far in advance. The other man with two single units had several problem cows in the middle of the line and the extra time required on them unbalanced the sequence and timing of practices. He prepared some of the cows too far in advance and time was lost because practices did not fit together.

The charts showing detail milking records indicate the importance of following a time sequence. The study indicates that individual dairymen who cull out problem cows, develop the essential skill in rapid milking, and adjust their practices to proper timing, can approach the goal of two man minutes per cow.

H. C. WOODWORTH, K. S. MORROW, J. C. HOLMES

## Studies on Bovine Mastitis

Studies were continued on the treatment of bovine mastitis with penicillin. One hundred and forty-one cows with streptococcal mastitis were treated in 285 quarters with one, two, or three injections of penicillin. The penicillin was administered via the teat canal in 50 *ml.* or 100 *ml.* of sterile water or saline in doses of 20,000, 50,000, 75,000, 100,000, or 200,000 units per injection. Cows were considered cured when no mastitis streptococci could be detected in the milk samples by bacteriological tests at least one month after treatment.

One injection of 100,000 units of penicillin per quarter cured 64 per cent of the cows and 72 per cent of the quarters treated. One injection of 200,000 units cured 86 per cent of the cows and 84 per cent of the quarters treated. Two injections of 50,000 or 75,000 units at intervals of 24 hours were no more effective than one injection of 100,000 units. Three injections of 20,000 or 75,000 units at 24-hour intervals produced the highest percentage of cures, 92 per cent of the cows and 95 per cent of the quarters being freed from infection by this procedure.

It was found that cows with a long-standing, chronic streptococcal mastitis are most difficult to cure and further information is necessary before final recommendations for treatment with penicillin can be made. Studies are now being conducted to determine whether one injection of 300,000 or 400,000 units of penicillin will cure this type of mastitis infection.

L. W. Slanetz, F. E. Allen

## ENTOMOLOGY

### Penetration and Toxicity of Contact Insecticides

Early in 1945, the discovery was made in the laboratory of the Department of Entomology that the chemical compound hexachlorcyclohexane possesses unusual properties as a contact insecticide. This discovery took place just before receipt of a British reprint describing this compound and noting its remarkable toxicity against insects.

The compound is related to many others which have a ring structure and which carry chlorine atoms in various positions. A series of compounds of this general description had been under study in the department. Several gave promise. But a simple benzene ring so treated as to break the double bonds and to carry one hydrogen and one chlorine atom on each carbon atom proved to be extraordinarily potent. This is the compound which properly is designated as hexachlorclohexane but which has received considerable publicity in the course of the year under the name benzene hexachloride.

Intensive work was started immediately on this compound. It was found that a household spray kerosene will dissolve considerable of the gamma isomer which is the active phase of the compound. Thorough investigations proved that as little as 0.05 per cent of the gamma isomer, when incorporated in a household spray kerosene, will bring about complete kill of houseflies sprayed on the toximeter in the entomology laboratory. The addition of a small percentage of pyrethrum extract, or suitable thiocyanate, produced a material giving quick paralysis of flies as well as complete kill.

Studies proved that several familiar organic solvents, such as xylene and cychlohexanone, will dissolve substantial percentages of the compound. By suitable choice of solvents the active isomer can be secured in important amounts.

Further investigations were directed toward reduction or elimination of the unpleasant musty odor of the compound. Expedients were devised for reduction of the odor, but this problem has not yet been fully solved.

Meanwhile, the presence of an unpleasant odor is of no importance in the use of the compound for control of many destructive insects, such as grasshoppers, chinch bugs, leaf-eating beetles, and others. Application on fruits such as apples was omitted until the compound could be rendered free of odor. But it was found that applications on various vegetables, such as tomatoes, cabbage, onions, and turnips, would not bring about unpleasant flavor.

Insecticidal dusts containing the compound was prepared, and for this purpose a power-driven micropulverizer was installed. Dusts containing the equivalent of 0.5 per cent of the gamma isomer were made in ample quantity. Other dusts were produced containing 1.0 per cent. Also, a dry spray suspension was prepared containing 2.5 per cent.

These materials were used on about 40 species of economic insects, including some which are difficult to control by means hitherto available. Adequate control was secured with nearly all.

In some instances, control was secured where other means hitherto available have not been satisfactory. Thus, a heavy outbreak of a leaf-tier was treated with a dust containing 0.5 per cent of the gamma isomer. Within an hour the larvae had left their shelters within webbed leaves and were on the ground. They soon died. Adults also were killed.

The compound supplements DDT in important aspects. For example, it is toxic against all species of aphids studied in the course of the season, whereas DDT is not equally potent. It is speedily effective against all species of thrips that were available for investigation.

Evidence was accumulated indicating that the vapor of the compound, at temperatures of 70°F or over, is toxic to some insects even though present in minute amounts. In this aspect, the compound is somewhat different from DDT which has lower vapor pressure. Also, its action is more rapid than that of DDT. With several important species of insects the toxic effects take place within a few minutes.

A special study was made of the gamma isomer and its relation to unpleasant flavor developed in some food products to which the complete compound had been applied. Evidence indicated that the gamma isomer does not in itself cause undesirable flavor. Thus, it is hoped that elimination of other parts of the compound will make it usable on fruits which otherwise would develop an unpleasant taste. This is also true on potatoes, although in this case either the character of the soil, or the moisture content of the potatoes, or both, appear to be significant, since undesirable taste was not developed in potatoes when grown in a sandy soil, and was associated with relatively high moisture content in the tuber itself.

Experiments in the treatment of pools in which mosquito larvae were breeding indicated that a dust containing 0.5 per cent of the gamma isomer, applied at the rate of 10 pounds to the acre, gave complete mortality of larvae, both surface-feeding and those which feed below the surface.

Intensive investigation of this material is continuing since it is undoubtedly of genuine importance to the control of destructive insects.

W. C. O'KANE, J. G. CONKLIN, W. J. MORSE

### Penetration and Toxicity of Ovicides

A compound applied to the eggs of an insect may not prevent hatching, but may cause death of the insect immediately on emergence from the egg. This is especially true where action of the compound is prolonged for a number of days, and is probably the mode of action of hexachlorcyclohexane with reference to insect eggs, although further studies may indicate that this compound, in a suitable penetrating agent such as

a light oil, may prevent the hatching of eggs. In this respect the importance of the liquid carrier for a compound, as already indicated in earlier work in this project, is emphasized.

W. C. O'Kane, J. G. Conklin

## Insect Record

Work on this project has continued along the lines followed in the past. Scouting in the summer of 1945, in anticipation of a possible outbreak of the spruce budworm, revealed the presence of light infestations of this insect in Colebrook, Clarksville, and Pittsburg. No noticeable defoliation has occurred. Preliminary scouting in 1946 indicates that the insect continues to be present in the northern part of the state, but there is still no indication of defoliation in the area examined.

The Japanese beetle population is apparently building up in Dover, Concord, and Keene. In Concord, sod samples indicated a grub population averaging between 40 and 50 grubs per square foot. Apparently this insect is reaching the point where noticeable damage to lawns may be expected shortly.

The fall webworm occurred in outbreak form throughout the state in 1945, causing extensive defoliation of shade trees.

The European corn borer was noticeably abundant in southern New Hampshire in 1945 but for the state as a whole showed a slight decrease over 1944.

J. G. Conklin

## Apple Maggot

In 1945 a 3 per cent DDT dust was applied to sod beneath apple trees as a possible means of destroying emerging apple maggot flies. This experiment was unsuccessful as a control measure, fruit in the orchard being 100 per cent infested with the apple maggot.

Gesarol AK 40 Spray (40 per cent DDT), at 1.5 pounds per hundred gallons, applied in three sprays to control the apple maggot, resulted in the production of fruit 97 per cent free of apple maggot injury. This was comparable to control obtained with two applications of lead arsenate at three pounds per 100 gallons.

J. G. Conklin, W. C. O'Kane

## Studies of Insects Affecting Spruce

The present outbreak of the spruce budworm in Canada and its spread into northern New York state and parts of Maine is a matter of concern to all timber-land operators in northern New Hampshire. Scouting of selected spruce-fir areas, in 1945, revealed the presence of light infestations of the spruce budworm in the extreme northern part of the state.

In order to obtain a check on the possible increase of the spruce budworm in New Hampshire, a series of permanent plots was established in June, 1946, and should give a means of measuring the budworm population throughout our spruce-fir areas.

The European spruce sawfly was present in very low numbers in all spruce stands examined in 1945. The insect has not yet shown any tendency to build up in numbers at any one point.

J. G. CONKLIN

## FORESTRY

### Sugar Maple Propagation

The seedlings from the sweet trees have grown vigorously and are of such a size that they were transplanted in the spring of 1946. Apparently, they have survived this operation; by 1947, they should be large enough to test for sweetness of sap.

The extra teaching load assumed this year made it impossible to carry on the investigations of the sweetness of our selected trees.

C. L. STEVENS

Two thousand maple cuttings of current season's growth were gathered during June, 1945, from various sources as follows: (1) two high-yielding trees at the Horticultural Farm; (2) two high-yielding trees at Georges Mills; (3) various low-yielding trees at Foss Farm. They were divided into lots for the following treatments with appropriate controls: Solution dip treatments using carbowax as a carrier with these compounds (1) p-chlorophenoxyacetic acid, (2) indolbutyric acid, (3) Methoxyacetic acid, (4) B-napthoxyacetic acid. All were used in four dilutions with water at 0.1 gram to 1000 down to 1,000,000 parts. In addition dust treatments were tried as follows: Rootone, Hormodin, ,and Dow Quick-Root No. 2, each alone, and with various proportions of Arasan and Spergon. All cuttings were placed in indoor and outdoor beds of sand.

Limited tests on effects of X-rays on rooting were made in the spring of 1946.

Numerous cuttings callused in various treatments and controls, but very few rooted. Only six out of the entire 2,000 rooted. This low amount of rooting in comparison to other years may have been due in part to the very wet spring which caused tender foliage, as there was an abnormal amount of rotting of foliage in the cutting beds. The results on X-ray effects were negative.

STUART DUNN, C. L. STEVENS

### Devices and Implements Useful in Farm Logging

A study of several devices has been made and photographs taken to show the construction of various devices and implements useful in farm logging. Wherever possible to obtain them, time studies, details of cost and construction have been obtained. The implements or devices are all in use and have proved to be useful in production as well as as economical of labor.

The following devices have been observed and studied:

1. Power-operated screw wedge for quickly splitting four-foot lengths of wood. Using an automobile rear wheel for power the screw splits dry hardwood 10″ to 14″ in diameter in five to 10 seconds.

2. A lightweight gasoline-powered drag saw of the wheelbarrow type bucks 16″ hard maple in one and one-half minutes. A small garden tractor motor delivers power either to the saw or to the driving wheel so that the machine is self-propelling.

3. A home-made fuelwood saw for mounting on standard type tractors runs on roller bearings. Belt tension can be altered by crank motion. The carriage feeds in a horizontal plane.

4. Wheel and sled arches for logging have been observed. Trees are felled and limbed, then twitched full length to yards or decks where they are bucked with chain saws. Complete time studies are available on these operations.

5. Mechanically operated stakes on log trucks prove efficient in unloading and as a safety measure to prevent serious accidents. These are in continuous operation and have been well liked by logging crews.

6. Several types of log loaders using winches, booms, cable, tongs, and dog are currently in use. These are mounted in various ways on tractors, trucks, old power shovels, and pipe layers. Time and labor saved are thought to exceed construction and operating costs. It is not necessary to build log decks and landings where loaders are used.

7. Other devices such as drop saws, conveyors, and hitches are also under current observation.

L. C. SWAIN

## Reproduction Studies

The routine measurements of growth and development have been made for the recent plantations, and three new small ones established, two coniferous and one deciduous. Inspection of the direct seeding plots established last spring shows that one of the various treatments was successful in repelling rodents. The sprout reproduction plots were not measured in the fall of 1945.

A few more species of tree seed were tested for quality during the spring of 1946. Since 1945 was not a seed year, we were not able to get the usual number of local species.

C. L. STEVENS

## White Pine Stands

Two small thinning plots were made by students during the winter. The usual records were kept to provide data for future analysis of results.

C. L. STEVENS

## Spruce Reproduction Studies

The only thing accomplished has been the sowing of a seedbed of White Spruce to provide seedlings for controlled condition experiments.

C. L. STEVENS

# FRUIT

## Leaf Scorch in Deciduous Fruit Plantings

Large branches of McIntosh trees susceptible to leaf scorch were injected with magnesium nitrate. One gallon of a dilute solution was absorbed very quickly and resulted in burning the edges of the leaves. In another block, known as the 35 Orchard, trees which had suffered annually from severe leaf scorch were selected for spraying tests. Certain branches were sprayed whereas others were left as controls. Magnesium nitrate and calcium nitrate were thus compared with relation to their effect on leaf scorch. Four sprays were given during the season. Ten per cent solutions each of calcium nitrate and of magnesium nitrate caused edge burning on the leaves, but 5 per cent solution sprayed on the branches increased leaf scorch.

The trees have been mulched for four years with either hay, dust, or seaweed. The mulches have not as yet reduced leaf scorch, nor is there any evidence that leaf scorch has been increased by such treatments.

Chemical analysis of leaves from the sprayed trees showed that leaves of healthy trees were higher in both calcium and magnesium than those of scorch-susceptible trees. After leaf scorch had appeared there was no difference in the calcium content between non-scorched and scorched leaves of the same trees, but the magnesium content of non-scorched leaves was twice that of scorched leaves on the same tree. With both healthy and scorched trees the calcium content of leaves rose throughout the season until by October 1 the percentage of calcium in these leaves was nearly twice the calcium content on the first of June. The magnesium content of good leaves on both healthy and susceptible trees remained practically constant throughout the growing season.

Two crops of oats were grown on soil which was obtained beneath scorch-susceptible McIntosh trees. Neither lime nor magnesium increased the growth or total weight of plants harvested over the control plot which contained no lime and very little magnesium. Oats have responded differently from corn and turnips tried previously.

L. P. LATIMER, G. P. PERCIVAL

## Radioactive Phosphorus for the Study of Plant Nutrition

A paper giving the results of previous work on the movement of radioactive phosphorus during the winter has been prepared. Data were collected by taking samples from plants fed radioactive phosphorus, having them ashed by the Engineering Experiment Station at the University of New Hampshire, and the radioactivity determined by the Physics Department of the Massachusetts Institute of Technology. An attempt to use a portable Geiger-counter to determine when radioactive phosphorus had started to move up the tree has not given satisfactory results. The concentration of radioactive phosphorus in the plants, when nutritive solution of the proper dilution is used, is too small to be detected with certainty by the direct application of the counter to tree trunks.

Sending materials to M.I.T. for analysis has required too much time, hence it will be necessary to secure new equipment locally available for making analyses before this project can be continued satisfactorily.

A. F. Yeager, L. P. Latimer

## Fruit Varieties

Medina is a new apple variety which shows considerable promise. In the trial plots at Durham Medina has borne early, has produced larger apples than Delicious which it somewhat resembles, and has kept unusually well in storage.

Among raspberry varieties, Viking is more resistant to spur blight than Latham or Taylor, but apparently its rest period is more easily broken; hence, there was more winter injury on it than on the other two varieties in the winter of 1945-46. Latham suffered less winter injury than the others despite its fairly heavy infestation with spur blight.

Winter killing in cherries was very severe this past winter and was closely correlated with the amount of leaf-spot injury during the summer of 1945, when many varieties were completely defoliated. Varieties which were most resistant to leaf spot, and which survived the winter in the best condition, were Belle Magnifique and Sweet September.

Oriole, Cumberland, and Colora peaches have again come through the winter with the largest number of live fruit buds.

The McIntosh variety of apple shows the heaviest infection with apple scab that has occurred in many years, enough so that considerable defoliation has resulted, despite an ordinarily adequate spray program. Cortland is apparently more scab resistant.

Of the grapes on test, Van Buren shows the greatest resistance to black rot, which disease practically destroyed the crop on most of the other varieties. Blue Jay is to date outstanding among the Minnesota hybrids. Moonbeam, Bluebell, and Red Amber have not proved as desirable. Bluebell has not been winter hardy. Red Amber and Moonbeam do not ripen properly before frost. Kendaia is winter hardy and vigorous, but has not produced as well as was expected. The quality of Kendaia is high. Fredonia is very satisfactory and is winter hardy, but the bunches are relatively small.

A. F. Yeager, L. P. Latimer

## Fruit Plants in Northern New Hampshire

Apples and pears have done better than other tree fruits in Coos County, particularly south of Stratford. Winter injury becomes serious from Colebrook northward. The best apple and pear trees were found in the town of Dummer at a high elevation and on a slope protected from cold west and northwest winds. Cortland seems hardier than McIntosh in this area, as evidenced by the fact that injury to this variety was found only at Pittsburg. Anoka has done the best of all varieties on trial, and Cortland seems somewhat hardier than Beacon. The Duchess variety and the Florence and Dolgo crabapples have done well. Prairie Spy showed considerable winter injury throughout the area.

Among the pears Patten and Bantam both did well generally, but Patton seems somewhat hardier than Bantam.

At Pittsburg, the Superior plum was hardier than Pipestone. Underwood was satisfactory in Colebrook, but Kaga was subject to winter injury. Mount Royal is less hardy and less vigorous than Pipestone.

The Nanking cherry did poorly in all sections.

Among the small fruits red raspberries did better generally than strawberries. Little or no winter killing was evident with the red raspberry. Latham and Indian Summer both do well although Latham was more productive. Whereas, Fairfax developed runners more freely than most of the other varieties, strawberries, in general, did not develop runners readily.

The Kendaia grape has proved a failure where not protected by snow. Beta killed back slightly at Colebrook, but was much more satisfactory than Kendaia.

L. P. LATIMER

### Strawberry Improvement

Crosses were made in the greenhouse between previous hybrids of cultivated varieties selected for late maturity of fruit, vigor, freedom from disease, and high yield and quality. Also, crosses were made between these types and the best selection from hybrids of cultivated and native wild types. During the summer, the latest maturing variety selected from previous crosses was crossed with Borden, a late blossoming Canadian variety. To date all the seedlings show great vigor and freedom from disease.

L. P. LATIMER

### The Use of Malling and Other Apple Rootstocks

Observations of the rootstock and body stock planting at Gilford this season indicate that Red Spy makes a more vigorous growth on all body stocks than does either McIntosh or Cortland, and that Red Spy overgrows the body stock of Virginia Crab. Red Spy trees on Malling No. 4 root compare quite favorably with standard trees of the same age, that is, six years. The Cortland and McIntosh on Malling No. 4 grow somewhat slower and appear to be quite weak unless located on the better soils in the orchard. On the best soils, trees of Cortland and McIntosh make very good trees. The Cortland variety looks well and makes a fine appearing tree on Virginia Crab and on Florence Crab body stocks. It is quite evident that body working has delayed the development of the trees as compared to those trees grown from a bud.

A progress report on the interstock planting will appear in the next issue of the A. S. H. S. Proceedings.

Annual measurements were made of the several varieties on the different Malling stocks. Northern Spy trees on Malling No. 1 make a fast-growing tree that has come into fruiting early.

W. W. SMITH

### The Development of Low-bush Blueberry Fields

Commercial fertilizer of a 7-7-7 strength was applied on larger areas than formerly. The residual effect of 7-7-7 fertilizer one and two years previous was considerable as noted by plant growth and fruit production compared to check plots. Plots were treated with fertilizers (5-10-10) lower in nitrogen and higher in phosphorus and potassium than in previous work. On other plots, a 7-7-7 fertilizer plus magnesium, calcium, and boron were applied.

In the weed control plots cutting at various times was practiced. Apparently July cuttings were more successful in killing the weeds and sprouts than later cuttings. Oil was used in burning some plots, but was not too satisfactory. Blueberry plants on which sawdust has been applied for two years are not as productive as untreated plants.

Selections of outstanding low-bush clons were transplanted into cultivated fields and were used for cross-pollination with the hope of crossing the low- and high-bush varieties.

W. W. Smith

### Ecological Factors Associated with Successful Low-bush Blueberry Production

Observations were made of the blueberry areas involving a correlation of soil, topographical features, and associated plant growth with the general productivity of the area. The plant particularly associated with good blueberry areas is spruce. It was noted that in the southern part of the state the northern slopes furnished better blueberry areas than did southern slopes and that most successful blueberry pastures are at elevations of 1200 feet or more. The soil type in the most successful areas seemed to be a sandy or gravelly loam type. The pH of 4.5 to 5.5 was also associated with good blueberry production. Experimental plots were established in several parts of the state where blueberries are not commercially important, but because of the presence of blueberry plants and other desirable features which indicate potential blueberry production it seemed probable that they might become productive.

W. W. Smith

## ORNAMENTALS

### Carnation

Two and one-half benches of carnations were planted to continue previous tests of carnation varieties. The plants used in this experiment were obtained by taking cuttings from December to February, flatted 3″ x 3″, and grown in a carnation temperature until late April. The flats were moved to coldframes and were benched from flats the first week in June. The plants were given the recommended cultural practices of feeding, temperature and spraying. Production records for the 16 varieties follow:

**Carnation Production Records**
**October 1945 - May 1946**

| Variety | Number of plants | Square feet of bench | Number of blooms | Square feet of flowers | Number of cuttings | Notes |
|---|---|---|---|---|---|---|
| Pink Treasure | 41 | 15.8 | 242 | 15.3 | 61 | Tendency to split |
| Casablanca | 42 | 17.2 | 303 | 17.6 | 34 | Excellent stems |
| Giant Fisher - 1 | 39 | 17.5 | 375 | 21.4 | 40 | Large flowers |
| Seth Parker | 42 | 16.4 | 362 | 22.1 | 64 | |
| Giant Fisher - 2 | 34 | 11.6 | 291 | 25.0 | 17 | |
| John Briry | 36 | 17.5 | 296 | 16.9 | 97 | |
| Dairy Maid | 41 | 17.5 | 380 | 21.7 | 31 | Late producer |
| Charm | 30 | 12.0 | 245 | 20.4 | 36 | |
| Rigolletto | 24 | 9.5 | 151 | 15.9 | 21 | Low production, poor keeper |
| Dark Fisher | 48 | 17.5 | 459 | 26.2 | 66 | |
| Baums Supreme | 48 | 17.6 | 357 | 20.2 | 89 | Large flowers |
| Grassl's White | 34 | 14.0 | 275 | 19.6 | 70 | |
| Libbie Jane | 38 | 16.4 | 210 | 12.8 | | Discarded-Grassy grower |
| Miller's Yellow | 36 | 15.0 | 266 | 17.7 | 91 | Best yellow |
| Rose Caress | 23 | 11.6 | 193 | 16.6 | 35 | |
| Olivette | 177 | 75.3 | 1397 | 18.6 | 146 | Short stem, good producer |
| King Cardinal | 176 | 84.0 | 1247 | 14.8 | 123 | Still best red |

The production records include the flowers cut from October 1, 1945, to May 31, 1946. Cuttings were taken from the plants in January and February. Insects were kept under control by the use of sodium selenate.

E. W. KALIN, J. A. MACFARLANE

## PASTURES

### Pasture Management Studies

The shift from corn silage to grass silage, and the accompanying disinclination on the part of the farmer to plow and re-seed as frequently as crop and soil needs indicate, have caused a reduction in the carrying capacity of some of our dairy farms.

The usual methods of growing grass silage produce so much less feed per acre than does corn silage that the carrying capacity of the farm is restricted. There seems to be less reason for fearing soil erosion on corn land than there is in reduced production when, from lack of plowing and re-seeding, hay production declines even below the level of that grown on eroded corn soils. The use of fertilizer for hay is still of minor significance.

On a theoretical basis, comparative costs and production indicate little advantage for either corn silage or late summer pasture to maintain milk production during this period. Total digestible nutrients produced

under the two systems approximate 243,140 for summer silage and 238,390 for Ladino clover pasture on areas equivalent in productive capacity. The additional silage area would provide 10,409 T.D.N.; oats pasture 19,080; and permanent pasture 112,500; a total of 141,989. Under a summer Ladino pasture system, oats pasture would provide 27,284 and Ladino pasture 94,000 units, a total of 121,284 T.D.N.

Labor requirements are quite similar. For summer silage, an approximate total of 1086 hours of man labor is required to produce the feed for 26 cows; while Ladino pasture would require 1116 hours of man labor.

Estimated cash costs are as follows:

| | | |
|---|---|---|
| Summer silage: | Seed | $ 88.00 |
| | Fencing | 25.00 |
| | Fertilizer | 531.00 |
| | | $644.00 |
| For Ladino pasture: | Seed | $116.00 |
| | Fencing | 10.00 |
| | Fertilizer | 597.30 |
| | Total | $723.30 |

Lime costs could be maintained at nearly the same figure, about 25 tons annually, after the system had been established.

The greater area of permanent pasture required for the summer silage system should offset the greater labor and seed cost for Ladino pasture for late summer feed. There would be some additional manure available from stabling the cows while feeding silage.

M. F. ABELL

### Producing the Full Roughage Requirements on New Hampshire Dairy Farms With Special Reference to Pastures

This project is being conducted on outlying dairy farms. During 1945, plots on seven farms were harvested and on three farms progress was made in getting the pastures from a plot to a field scale. One or two additional farms will be added in 1946, on which separate fields will be seeded to one of the large grasses supplemented with Ladino clover.

In a three-year summary covering the data for six grasses from all the plots which have been harvested, smooth brome leads in total pounds of forage produced, while timothy is last. A three-year summary follows:

| Kind of Grass | Pasture Years | Oven Dry Material Per Acre |
|---|---|---|
| Smooth Brome | 12 | 5615 |
| Orchard Grass | 18 | 5358 |
| Tall Fescue | 11 | 5326 |
| Perennial Rye | 12 | 4978 |
| Reed Canary | 10 | 4948 |
| Timothy | 15 | 4810 |

The column "pasture years" is the sum of the number of the plots harvested for a whole season for the three-year period. The plots were

originally seeded to one of the grasses named, with Ladino clover. The harvests represent either this mixture, or just the pure grass in cases in which Ladino was winterkilled or reduced by overgrazing, or the grass with Ladino and any other grasses such as Kentucky blue grass or bent grass which may have volunteered into the stand.

In regard to seasonal distribution of forage produced, smooth brome has given the highest early yields, with tall fescue producing much higher autumn yields than any other grass.

Comparisons between complex seeding mixtures, including Ladino and one of the large grasses with Ladino, are available on two farms. In each case, the pastures were seeded in 1942. The 1945 harvests show a difference of 1400 pounds of dry matter in favor of the simple mixture with Ladino. This superiority is due, principally, to the greater freedom which Ladino enjoys in the simple mixtures by not having so much competition with red top and other sward forming grasses.

Two rate-of-seeding tests with orchard grass indicate that good stands and satisfactory yields may be secured on carefully prepared land with as little as three pounds of seed per acre, although heavier seeding rates up to 10 pounds have given slightly higher yields of dry matter.

F. S. PRINCE, P. T. BLOOD

### The Improvement of Ladino Clover, Red Clover, And Timothy by Selection and Breeding Ladino Clover

Twenty-four plants were propagated clonally in a seeding with new orchard grass in 1944. Their behavior varied to the extent that many new ones will be selected for developing a new strain rather than those originally chosen. These will be caged in 1946.

Twenty seedlings from each of seven parents grown under a cage in 1944 were produced in 1945 in rows with Ladino for comparison. On the basis of observation and scoring, six of the seven were distinctly superior to Ladino, but these do not represent necessarily the best material from the breeding program.

Seventy-four plants of white clover and 90 of Ladino clover were grown in spaced rows from seed received from the Pasture Laboratory in April, 1944. While these plants exhibited some variation, they represent very desirable material on the whole. Some of these have been brought into the greenhouse for intercrossing with a few of the more desirable New Hampshire Ladino families.

*Red Clover.* Over two dozen vigorous red clover plants have been potted and placed in the greenhouse for hand intercrossing. These plants are descendants of the 12 original families that lived and produced seed for four or five seasons. Weak plants and those that show susceptibility to disease are being discarded.

Comparative trials with perennial red clovers from other sources are under way. During the past season, about two bushels of seed of the New Hampshire perennial strain were produced. This will be distributed to other stations and used for comparative farm tests throughout the state.

*Timothy.* The testing of two strains of timothy is now proceeding on a field scale in various locations in New Hampshire. The two strains include, (1) a late hay strain, and (2) a shorter strawed, but very leafy strain designed for pasture. Seed of both strains has been multiplied so that enough is available for farm as well as comparative testing by the Agricultural Experiment Station.

F. S. PRINCE, L. J. HIGGINS, P. T. BLOOD

## The Use of Herbicides in New Hampshire With Particular Reference to Pastures

The following herbicide treatments were made:

(1) 2,4-D in carbowax and either the sodium or ammonium salt of 2,4-D as well were applied in water solution at different times and under different environmental conditions to the following weeds in pastures and fields: (a) Field Buttercup, *Ranuculus acris,* (b) Bindweed, *Convolvulus sepium,* (c) Poison Ivy, *Rhus radicans,* (d) Yellow Rocket, *Barbarea vulgaris,* (e) Canada Thistle, *Circium arvense,* and (f) Yellow Devil's Paintbrush, *Hieracium pratense.*

(2) Broadcast applications of granular Borax $Na_2\ b_4\ O_7\ .6H_2O$ were made on the above-named weeds with the exception of Yellow Rocket.

(3) Applications of Ammate at three ounces and at six ounces per gallon of water were applied to Field Buttercup, Bindweed, Canada Thistle, and *Hieracium.* Ammate at 12 ounces per gallon was used on Poison Ivy.

(4) Sinox was tried but was discontinued on perennial weeds.

(5) 2,4-D at one part to 1000 parts of water and Ammate at three ounces per gallon were applied to a number of lawns at different times and under varying conditions.

(6) Several species of miscellaneous weeds were treated with the above-named herbicides.

In general, the 1945 results showed that Ammate at three ounces per gallon of water is effective against a variety of pasture and field weeds in late spring treatments. Clovers tend to be destroyed temporarily but come back after a few months. Grasses tend to be stimulated. In many cases where Ammate failed, 2,4-D acid and its salts of Ammonia and Sodium proved effective, but proved distinctly inferior to Ammate in the treatment of Buttercup and somewhat inferior in the case of Paintbrush.

Borax in heavy applications showed promise in long-time pasture renovation. Plots treated several years ago with Borax at two to three pounds per hundred square feet showed excellent grass and clover growth in 1945, while adjacent untreated plots were quite valueless as pasture.

The results, in general, indicate that most herbaceous pasture and field weeds lend themselves to herbicide treatments. A combination of

herbicide control and pasture management, including fertilization, should proceed hand-in-hand to bring about effective weed control.

A. R. HODGDON

# PLANT PATHOLOGY

## The Testing of New Pesticides

Six applications for each of 18 fungicide treatments were made during the 1945 season on New Hampshire Victor tomatoes to control *Alternaria solani.* Single hill units with 10 replicates for each treatment used were arranged in a randomized block. The concentrations of the materials used and their effect on control of defoliation were as follows: Dithane (Disodium ethylene bisdithiocarbamate) (½-100 + $ZnSO_4$ and lime**), Puratized (Phenyl mercuri triethanol ammonium lactate) (1-20,-000**), Bordeaux (3-3-50**), Zerlate (Zinc dimethyldithiocarbamate) (2-100**), Copper oxychloride sulphate (6-100**), Phygon (2.3-dichloro-1,4-naphthoquinone) (1-100**), Fermate Dust (Ferric dimethyldithiocarbamate) (10-90*), Tribasic $CuSO_4$ (3-100*), Spergon (Tetrachloro-para-benzoquinone) (1-100*), Fermate + DDT (2-.6-100), Fermate (2-100), Fermate (1-100), Fermate Dust + DDT (10-3-87), Bismuth Subsalicylate (1⅓-100), Fermate (1-100) + sticker, Q15 (Lauryl isoquinolinium bromide) (½-100), No Fungicide. Average weights in pounds of marketable tomato fruit per plant for each treatment were: Zerlate (8.20**), Puratized (7.93**), Phygon (7.70**), Fermate 2-100 (7.47**), Tribasic $CuSO_4$ (7.34**), Fermate 1-100 (7.09*), Bismuth Subsalicylate (6.30*), Fermate 1-100 + sticker (6.00*), Dithane (6.00*) Fermate Dust (6.00*), Fermate + DDT (5.80), C.O.C.S. (5.67), Bordeaux (5.50), Fermate Dust + DDT (5.30), No Fungicide (5.00), Spergon (4.80), Q15 (3.98). None of the fungicides prevented eventual complete defoliation by Alternaria. Definite injury to foliage was noted with Dithane, and stunting of the plants was indicated with Bordeaux and Copper oxychloride sulphate.

M. C. RICHARDS, R. C. JONES

The Department of Entomology, co-operating, applied DDT in the form of Gesarol A-3-Copper dust (3 per cent DDT) throughout the 1945 season as a control for potato insects in foundation stock plots of Mohawk and Sebago potatoes. A total of six applications was made, beginning July 7.

Excellent control of flea beetles and Colorado potato beetles, and tarnished plant bugs was obtained. In the case of potato aphids, injury was prevented, but some aphids could be found especially on the lower leaves late in the season. These were principally the green peach aphid, an important vector of potato leaf-roll virus. The results indicate that while this form of DDT will give excellent control of potato insects grown for table stock, it cannot be expected to solve the problem of leaf-

*Significantly (19:1) better than "No Fungicide".

**Highly significant (99:1).

roll spread by aphids late in the season. It is conceivable that improved equipment for the application of DDT, which will enable the grower to obtain a more complete coverage of the lower leaves of the potato plant, may prove helpful.

DDT in the form of 3 per cent dust, applied to Marglobe tomato transplants the day after setting in the field and again 16 days later, gave excellent control of flea beetles and caused no apparent plant injury.

In the spring of 1945, DDT at the rate of two pounds per acre, combined with Vigoro fertilizer at the rate of 1000 pounds per acre, applied by means of a mechanical spreader to approximately one acre of lawn heavily infested with Japanese beetle grubs, reduced the grub population approximately 90 per cent. At the peak of beetle flight later in the season the treated area was relatively free of adult beetles.

J. G. Conklin

## Plant Disease Investigations

Three varieties of raspberries, Taylor, Latham, and Viking, were sprayed April 9, when the plants were in the late delayed dormant stage, with 1 per cent Elgetol. Some injury to the exposed leaves occurred at this concentration, but no permanent injury was evident. Periodic inspection of the fruiting bodies of spur blight pathogen showed that spore development within the fruiting bodies ceased if the canes were covered by the spray material. No further spray applications were made during the growing season. On October 29, 1945, data taken showed the presence of spur blight lesions on each of the three varieties as follows: Taylor 96 per cent, Latham 96 per cent, and Viking 80 per cent. Average number of lesions per cane were: Taylor 3.3, Latham 3.5, and Viking 1.4. Winter injury on the above varieties, as observed in May, 1946, was greatest on Viking which showed the least amount of spur blight both as to the number of canes infected and the number of lesions per cane. The test this year indicates that one Elgetol spray in the spring of the year is not sufficient to control spur blight, and that winter injury is not directly correlated with spur blight.

M. C. Richards, R. C. Jones

## The Control of Tomato Diseases

In former tests it was found that tomato varieties having a heavy fruit-to-leaf ratio defoliated earlier than those with a high leaf-to-fruit ratio. The leaves appeared to become susceptible to attack by the pathogen as the nutrients were drained from the leaves by the rapidly developing fruits. In 1944, and again in 1945, attempts were made to supply the roots of the test plants with an excess of N, P, and K so that a higher level of these nutrients could be maintained in the leaves during the fruiting period. The New Hampshire Victor tomato variety was used, as it fruits abundantly and defoliates severely. Inorganic nutrients of N, P, and K were added to the soil at the base of each plant, about six inches deep, when the plants were set in the field from three-inch pots. The tests were arranged in randomized blocks with five replications per treat-

ment. In one block ammonium nitrate, calcium cyanide, ammonium sulphate, sodium nitrate, and Uramon (Urea) were used as N sources and applied at the rate of 100 pounds of N per acre plus $P_2O_5$, 75 pounds, and $K_2O$, 45 pounds per acre. In other tests the N-P-K ratios were varied from 0-2-1.75 to 4-2-1.25, the nitrogen varying from 0 to 17, 35, 70, and 140 pounds per acre, with P and K remaining as given above. In further tests the total pounds of N, P, K per acre were varied. In general, there was an increase in the total fruits per plant with increases in nutrients applied. As a result, the high fruit-to-leaf ratio was maintained, and defoliation was as heavy on these as on the checks. Although abundant soil nutrients were available, a limited number of tissue tests did not reveal increases of N, P, or K in the leaf petioles.

M. C. RICHARDS, R. C. JONES

### Factors Influencing the Development or Suppression of Leaf-Roll Symptoms in Potato Foliage

From December to March, when days are short and cloudiness frequent, the leaf-roll symptom can be masked in the Green Mountain variety of potato grown in the greenhouse by adding to the soil certain soil nutrients at planting time. When tubers with severe net necrosis were planted in six-inch pots to which 11 grams of sodium nitrate or 8-16-16 fertilizer had been added, the leaf-roll symptom was absent in from 75 to 100 per cent of the plants. Plants from sections of the same tubers planted in pots with 11 grams of superphosphates or potassium chloride had well-developed symptoms in 87 to 100 per cent of the cases. Plants in the pots containing nitrogen or complete fertilizer showed a higher percentage of masking when the soil was kept relatively dry. The masking was less when the tests were repeated in April and May, and no masking occurred when similar tests were made in the field during the summer. There appears to be a relationship between light conditions and nitrogen nutrients with respect to the suppression of the leaf-roll symptom in the Green Mountain potato.

M. C. RICHARDS, STUART DUNN, R. C. JONES

## POULTRY

### Protein Requirement of Chickens at Various Stages of Growth and Development

It has been possible during the year to complete the study involving the pH of the gastro-intestinal tract. This study was deferred during the war emergency. To obtain data on the normal pH of the digestive tract pH determinations were taken on individual chickens at three- and four-day intervals from age 16 days to 101 days. From 101 to 164 days of age, the pH was taken at seven-day intervals. Seven or more chickens were used for each set of determinations. The digestive tract was divided into 10 parts and a minimum of two readings was taken on each part. There were used 247 chickens of which 116 were males and 131 were females. A

total of 5885 pH readings were taken. The feed used was commercially mixed poultry feed.

Preliminary analysis of the data indicates that the pH of the digestive tract, with the exception of the gizzard, is relatively stable up to 164 days of age. The pH of the gizzard changed from a range of two to three during the early growth period to a range of three to four during the middle and later growth period. A complete summary of the data is being prepared for publication.

R. C. Ringrose, T. B. Charles, S. R. Shimer, H. A. Davis

## A Study of the Cause and Prevention Of Gizzard Lesions in Chickens

One of the major problems in this study has been the uniform production of the gizzard lesion. Without uniform production of the lesion at a fairly high rate of incidence it is difficult to evaluate effectiveness of the corrective measures applied.

During the year, a semi-purified basal ration has been developed which thus far has given very good results. Growth has been exceptionally good and averages 340 grams at four weeks of age. Gizzard scores, the method of measuring results, have been within the range of 1.4 to 1.7.

Attention also has been directed toward methods of measuring results to supplement the visual scoring used in the past. Cholic acid is known to be effective in preventing the lesion and is also known to be present in the gizzard lining. Cholic acid determinations on pooled gizzard linings are now being used to supplement the visual scoring. To date the cholic acid content of the gizzard lining has varied in the same direction as the visual scores.

Alfalfa meal and oats have been reported as good sources of the "antigizzard erosion factor." Under test conditions 45 per cent of ground oats or 20 per cent of alfalfa meal has but slight, if any, protective action.

R. C. Ringrose, H. A. Davis

## Choline in the Nutrition of Poultry

During the year, a study of the choline requirements of laying hens was initiated. For this purpose a semi-purified ration which analyzed .037 per cent choline was developed. New Hampshire pullets which had been laying for six months were placed in individual laying cages. Twelve birds were placed on the low choline control ration and six birds were placed on each of the rations to which various amounts of choline chloride had been added.

Records of feed consumption, egg production, and body weight were taken for a period of 84 days. Choline analyses of pooled egg yolks were made at the end of each 28-day period. No significant differences which could be related to the choline content of the rations were recorded.

One group on a so-called low methionine low choline ration was included in the study. This ration analyzed .04 per cent choline. Amino acid composition of the ration was calculated from average analyses for

crude casein, gelatin, and primary brewer's yeast. The calculated values obtained were .380 per cent methionine and .094 per cent cystine. Results on this ration were slightly more satisfactory than on a ration containing .10 per cent choline and calculated to contain .670 per cent methionine and .138 per cent cystine from the same protein supplements.

R. C. RINGROSE, H. A. DAVIS

### Blue Comb

Beginning on April 24, 1945, and continuing through July 27, 30,250 birds were vaccinated for the prevention of Blue Comb (contagious indigestion). Results indicate that this vaccination controlled this disease on eight poultry farms where used. Had sufficient vaccine been available, at least 100,000 birds would have been vaccinated for control of the disease.

T. B. CHARLES

### Chore Efficiency on Poultry Farms

Chore practices were studied on 11 commercial poultry farms. Stopwatch time records were taken in each case and observations were made as to equipment and how the chores were done. Special emphasis was given to feeding, gathering eggs, and watering.

The total time for these three practices varied from 47 to 121 man minutes per 1000 layers. The differences in time were due to the following factors:

1. Personnel
2. Equipment
3. Type of watering system
4. Number of trips
5. Feeding program
6. Pen arrangements
7. House plan

The operators with low time records obtained their efficiency by simplifying the feeding program and combining chores, thus reducing to three the number of daily trips through the houses. By the use of carriers feeding was done when traveling through the series of pens from the storage room, and eggs were gathered on the return trip. Water bubblers were observed on each trip.

The greatest variations among farms were due to differences in watering. This was particularly a difficult problem in some houses in the winter on account of freezing. Operators with insulated houses used the automatic bubbler type fountains without difficulty. These required little attention. Some of the operators filled the water containers by hand which required considerable time. Lack of adequate water pressure was a special handicap on some farms.

Of course, the men who simplified and combined the chores had less travel. One man, making three trips daily through the pens, traveled 144 feet in going through each pen and 204 feet in doing the chores within

each pen. Another man, making 10 trips daily through the pens, walked 480 feet through each pen and 414 feet in doing the chores within each pen.

The study indicates that with good organization and well-planned buildings, very little time is required for doing daily chores in handling the laying flock.

The project was carried out by Edward Piper under the supervision of an informal committee consisting of the Agricultural Economics and Poultry Department staffs.

E. Piper and Committee

## SOILS

### Methods for Controlling Erosion on New Hampshire Potato Farms

During the past year, measurable runoff at the Northwood Ridge plots occurred 14 times with some soil loss occurring 10 times. The soil losses from the non-green manured plots were again two to three times as great as from the winter rye plots.

For the third successive year the average yield of potatoes from the winter rye plots exceeded that from the non-green manured plots, the increase being 21.9 bushels. The largest yields of potatoes were obtained on the clover-hay rotation plots, the average yield being 46.7 bushels greater than that of the non-green manured plots.

The average yield of the potato plots on the severely eroded area at Strafford Ridge was only 53.3 per cent of the average yield at Northwood Ridge. The three highest yielding plots at Strafford Ridge were those receiving organic additions in the form of green manures, such as rye grass, crimson clover, and winter rye. It is strongly indicated by the results that restoration of organic matter to the severely eroded soil of this experimental area is essential to obain adequate yields of potatoes.

The study of topsoil-subsoil interrelations were extended to the field on small plots 10 feet by 10 feet from which none, one-half, and all of the topsoil were removed. Two each of these plots with different depths of topsoil were fertilized and two left unfertilized. The fertilizer used was equivalent to 1000 pounds per acre of a 5-25-5 formula. Vicland oats were grown and yields of forage and grain were determined.

The importance of preventing losses of topsoil was strikingly demonstrated by the results for the unfertilized plots. On these plots virtual crop failure resulted when 100 per cent of the topsoil was removed, with a grain yield of only 7.8 bushels per acre, whereas with 0.0 per cent of the topsoil removed the grain yield was 61.2 bushels. When 50 per cent of the topsoil was removed the yield of total forage decreased 60 per cent and the yield of grain decreased 65 per cent.

The heavy fertilization increased the grain yield of 54.0 bushels on the 100 per cent removal plot, to 86.4 bushels on the 50 per cent removal plot, but only to 63.9 bushels on the 0.0 per cent removal plot because the latter lodged severely from the excessive fertility.

L. T. Kardos

### The Influence of Soil Texture, Soil Moisture, and Soil Aeration on the Growth of Plants

*Soil Cultures.* Potatoes were grown in two types of soil, Buxton clay and Newmarket fine sandy loam. Some were grown as a control in untreated soil except for fertilizer, and others in soil treated with varying amounts of lignin and lignin impregnated with sulphur. Tomatoes were grown in other cultures with additions of various organic materials such as lignin, peat, neutral lignin, and rotten wood. Analysis of the soil for nutrients was performed after some of the crops were grown. Onions, beans, and lettuce were grown in a few similar cultures.

Amendments of soil with lignin, in general, gave increased yields of potatoes over controls. Lignin with added sulphur is of doubtful value. Peat showed some benefit in limited trials. Tomatoes showed no benefit from any organic material except with rotten wood. The soil nutrient tests with the tomato cultures showed complete exhaustion of nitrate nitrogen at maturity with all organic materials added, as compared to a small amount left in the controls. Onions showed distinct benefit from lignin applications, but lignin plus sulphur was detrimental. Beans and lettuce showed no benefit.

*Sand and Water Cultures.* Sunflowers were grown in sand and gravel culture with modifications of texture by additions of methocel, a colloidal organic compound of high viscosity, and colloidal lignin. The effect of methocel in causing better growth was much greater in fine texture than corresponding treatments in coarser texture. Lignin effects were very similar. Corn and tomatoes were grown in water cultures with small amounts of lignin, methocel, and colloidal clay added to the nutrient solutions. No benefit was obtained from such additions except a slight one with colloidal clay. Evidently one effect of these colloids may be to form a film around the sand particles which is beneficial perhaps in holding nutrients. This effect would be absent in water cultures.

STUART DUNN

## VEGETABLES

### Squash Storage

The Butternut variety of squash, a *Cucurbita moschata,* which has become very popular in this area in recent years, was given considerable attention in the squash storage trials of 1945-46. Stem removal and heat curing for two weeks, as were found effective with Blue Hubbard, also benefited Butternut. Waxing proved effective in overcoming the tendency of the Butternut squash to shrivel, but increased spoilage from black rot. Squash dipped in formaldehyde and not waxed shriveled worse than the untreated squash, but did not show so much black rot. Those treated with formaldehyde and then waxed were much brighter in appearance and kept in storage for a much longer time than under any other treatment. The stem ends of Butternut squash were found to contain more dry matter than the seed ends. When the squash were cut at harvest

time, leaving the seed end separated from the neck, it was found that the neck retained its dry matter content without a great amount of loss, but that black rot attacked this portion of the fruit. The seed end, on the other hand, was not attacked so much by black rot, but the loss in dry matter content was very marked.

A. F. YEAGER, M. C. RICHARDS

The Department of Agricultural and Biological Chemistry, co-operating, examined chemical changes occuring in squash during storage. Aside from contributing to the knowledge of the carbohydrate metabolism of this fruit, several practical points may be emphasized. In the first instance, there are very large amounts of sugar present at edible maturity. Since the sugars are very soluble, any method of cooking or processing, which allows drainage of water, results in large losses of food value.

Furthermore, there is a great loss of food carbohydrates during long storage. In six months this amounts to well over half of the amounts present at harvest. Some of this cannot well be prevented, as brief storage after harvest is needed to develop satisfactory flavor. The remainder of the loss, however, could be avoided by processing as soon as this stage has been reached.

## Breeding Work

*Early Tomatoes.* Much attention has been given during the year to the development of satisfactory early tomatoes with a high vitamin C content, and considerable progress has been made. Selections now available are approaching marketable size and carry a vitamin C content in the summer months of above 50 milligrams per 100 grams, compared to a normal of 20 grams for standard varieties. Continued selection for tomatoes adapted to northern New Hampshire has been made. These are of the determinate plant type and ripen well in the short season north of the White Mountains. For that section a variety with tangerine flesh has been distributed for testing.

A. F. YEAGER

*Muskmelon.* An early, high-quality muskmelon, somewhat resembling Honey Rock, has been sent out for testing this year under the name Granite State. This is not a perfect-flowered variety. Further selections for high-quality, perfect-flowered varieties are continued and some new crosses between the best perfect-flowered plants and Granite State have been made.

A. F. YEAGER

*Bush Squash.* A new variety of winter squash resembling Buttercup in fruit, but one which sets squash close to the crown similar to bush summer squash has been distributed for testing this year under the name Bush Buttercup. Our stock seed was produced at Colebrook, north of the White Mountains, which indicates that it is adapted to that area where the Blue Hubbard will not mature.

A. F. YEAGER, H. S. CLAPP

*Beans.* A selection from a local New Hampshire variety of beans, known as Elisha Smith, has been introduced for trial under the name of New Hampshire Red Kidney. Under our conditions it has given an earlier and heavier crop than the ordinary red kidney from which it is indistinguishable in the dry stage.

A small-podded green snap bean with white seeds has been named Tiny Green and distributed for testing. It has been found to be very satisfactory for whole canning.

A. F. YEAGER

# STATE SERVICE

## Inspection of Fertilizers and Feedingsstuffs and Soil Testing

In accordance with the public statutes which regulate the sale of commercial fertilizers and concentrated commercial feedingstuffs, 40 brands of fertilizers and 348 brands of feedingstuffs were analyzed during the year 1945-46. These analyses involved individual determinations totaling 284 and 1853 respectively. Co-operation in work on analytical methods with the American Association of Feed Control Officials and with the Smalley Foundation has been continued.

Samples of feeds, fertilizers, and other materials have been analyzed for residents of the state. Thirty-seven samples have been examined, involving 115 determinations. Also, more than 1000 samples of soils have been tested for residents of the state.

T. O. SMITH, H. A. DAVIS, G. P. PERCIVAL

## Seed Inspection

The regular seed inspection work for the State Department of Agriculture during the year involved 1988 samples handled in the laboratory. Of this number 296 were collected by the State Inspectors and reported in Station Bulletin 365; 1692 samples were sent in by seed dealers in compliance with the seed law which requires that all vegetable and agricultural seed must have been tested for germination within nine months prior to being offered for sale. Thus, much of this testing concerned seed carried over from the previous season. A few of these samples were sent in by farmers who had grown beans or corn and wished to sell it for seed.

B. G. SANBORN

## Necropsies Performed at the Poultry Pathology Laboratory

During the fiscal year 1945-1946, 2252 specimens were submitted to the Poultry Laboratory for diagnosis. These represented 975 cases. A total of 1916 chickens were examined, 1640 from poultrymen and 276 from the University of New Hampshire flock, (808 cases). The remainder of the specimens consisted of 241 turkeys (89 cases) and 95 miscellaneous (78 cases).

A. C. CORBETT

## Pullorum Testing

During the fiscal year 1945-46, the staff conducted blood tests for pullorum disease on 1,378,297 hens and related fowl, and retested 101,924 birds, making a grand total of 1,480,221 blood samples analyzed. Both the number of fowl tested and the total tests conducted were the greatest in the history of the pullorum-testing program which was inaugurated in 1918-19.

The birds tested were from 869 flocks of which 35 flocks were found to be infected. The infected flocks contained 62,791 birds of which 456 birds reacted to the test. Thus, pullorum disease was found to exist in 4 per cent of the flocks tested and .033 per cent of the birds tested.

Pullorum disease has been on the increase in New Hampshire as well as in most of the New England States since 1941. This may be directly attributed to the war which brought about a tremendous increase in the poultry population. New poultry farms were started and much stock was introduced from distant states. Much of this stock was infected and created new foci of infection. It is hoped that a return to more normal conditions will bring the degree of pullorum disease to the low point enjoyed in 1941.

F. E. ALLEN, A. C. CORBETT

## Infectious Bronchitis Work

During the fiscal year 1945-46, 36 poultry flock owners brought birds to the University to be inoculated with infectious bronchitis virus. The virus produces the disease in the birds inoculated but upon recovery they have developed a life-time immunity and thus they will not break down with the disease at some later date when they may be at their peak of production. Although the use of this virus is limited to those farms where infection has existed in the past, the disease seems to be increasing each winter; thus, the demand for inoculations in summer is increasing yearly. The cost for such service is pro-rated among those poultrymen benefitted.

F. E. ALLEN, A. C. CORBETT

## National Poultry Improvement Plan and National Turkey Improvement Plan

The National Poultry Improvement Plan (N. P. I. P.) is now in operation in 47 states. The official agency for this state is the New Hampshire Poultry Improvement Board, Inc., which consists of 10 members from the industry. Co-operating with this agency are the Agricultural Experiment Station and the State Department of Agriculture.

*Approval and Certification.* Because of the heavy liquidation of poultry and lack of personnel to make check inspections during the fall months, participation under the plan shows a decrease from the previous year. There were 172 check inspections completed, covering 250,278 birds under Approval and Certification. Had it been

possible to make the inspections during the fall, the figures would have shown a substantial increase over the previous year.

*Record of Performance (R. O. P.).* There were 54 R. O. P. inspections made on the 11 poultry and two turkey flocks participating. For the 1944-45 R. O. P. year, 7035 birds were trapnested, of which 2841 (40 per cent) qualified.

*Register of Merit (R. O. M.).* New Hampshire breeders had 2872 birds in 215 special matings during the past hatching season.

E. T. BARDWELL, D. F. WOODWARD

## Dairy Testing

For the year ending June 30, 1946, 272 samples of milk and cream have been tested for butterfat, 21 samples for bacteria, and nine samples of ice cream for total solids.

During the year, 444 milk test bottles and 110 pipettes were calibrated.

Other services covered under Dairy Bacteriology Testing include the supplying of Babcock glassware to the D. H. I. A. testers.

H. C. MOORE

A total of 314 samples of milk submitted by New Hampshire dairymen and veterinarians were diagnosed for bovine mastitis.

L. W. SLANETZ

**Expenditures for the Fiscal Year Ending June 30, 1946**

| | Hatch | Adams | Purnell | Bankhead-Jones | Supplementary* |
|---|---|---|---|---|---|
| Personal Service | $10,974.14 | $13,684.45 | $51,088.15 | $7,883.31 | $33,816.59 |
| Travel | 350.84 | 60.92 | 2,124.60 | 586.80 | 1,600.95 |
| Transportation of Things | 332.79 | 8.45 | 104.54 | .75 | 45.75 |
| Communication Service | 514.40 | 3.36 | 78.23 | 29.20 | 352.11 |
| Rents and Utility Services | 700.00 | 80.00 | 147.46 | 98.00 | |
| Printing and Binding | 540.42 | --- | 1,192.10 | --- | 66.44 |
| Other Contractual Services | 320.77 | 58.29 | 926.07 | 166.03 | 124.15 |
| Supplies and Materials | 557.48 | 463.69 | 2,858.00 | 430.45 | 5,336.63 |
| Equipment | 709.16 | 640.84 | 1,480.85 | 21.82 | 1,687.45 |
| Lands and Structures (Contractual) | --- | --- | --- | --- | --- |
| | $15,000.00 | $15,000.00 | $60,000.00 | $9,216.36 | $43,030.07 |

*This fund includes monies from the following sources:

| | |
|---|---|
| State Money for Bankhead-Jones Offset | $ 9,216.36 |
| Miscellaneous Income | 30,818.13 |
| Federal Sales | 2,995.58 |